JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

AUGUST, 1857.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Practical Views on the Proposed Improvement of the Ohio River. By W. Milnor Roberts, Civil Engineer.

(Continued from page 38.)

Capabilities of the Tributaries for Large Reservoirs.

It would appear, that excluding for the present, sites on the main rivers Ohio, Monongahela, and Allegheny above Wheeling, the following tributaries drain area of country enough to cover one of the requirements, namely, 600 square miles. *First*, the Big Beaver River, which as it enters below Pittsburgh, is of little or no account in connexion with the present investigation. *Second*, the Youghiougheny river which will furnish a site for a dam 100 feet high; but on account of the great fall in the stream at any point where such a dam would probably be admissible, the pool would not be likely to contain one-fourth of the assumed drainage. *Third*, the upper part of the main Monongahela river; this will probably furnish one good site. *Fourth*, French Creek; on this a dam 100 feet high could be erected, as herein described, but it would not contain more than half of the required quantity. *Fifth*, the Connewango, which may possibly afford a favorable site. *Sixth*, the Kiskiminetas river; although this drains ample territory, there are serious obstacles, as we have shown, in the way of erecting a large dam anywhere on this stream; and nowhere can the erection of a dam of 100 feet height secure the quantity of water assumed. *Seventh* and last, is the Clarion River; and upon this, from the data known, it is almost cer-

tain that a 100 feet dam will not create a pool sufficiently large to contain one-third of the drainage of 600 square miles. Above Pittsburgh, then, independently of the site referred to on the main river Monongahela, in Virginia, there are but five streams that drain 600 square miles; on not one of which is there any reasonable probability that a dam of 100 feet height would form a pool of such size as would contain the drainage of the area named, even estimating at an average of 12 inches, instead of 18 inches, as assumed by Mr. Morris. Either a greater number of dams, or much *higher* structures than the highest yet contemplated must be employed.

The writer is led to infer, that neither Mr. Ellet nor Mr. Morris, in advocating the construction of feeding reservoirs, had taken time to look into the probable practical result of their construction at any *particular points*. Mr. Morris says, "can we find six reservoir sites upon as many creeks, each draining a basin equivalent to 40 miles long by 15 miles wide?"

"Can proper locations be found at the lower ends of these basins for the *six* dams necessary to form six lakes, commanding each a drainage of 600 square miles? Or for a greater number of lakes of equal aggregate capacity."

"For the present, we will assume (what we do not doubt), that *six* suitable sites can be found, and that six dams can be erected, *each* ponding back, or giving an annual available capacity of 25,000 millions of cubic feet of water."

Yet the facts, so far as they can be given approximately without further careful surveys, go to prove that no such sites exist on the creeks. Again, Mr. Morris gives the dimensions of "The Saint Ferrèol Reservoir, built in 1667, the oldest large reservoir is existence, as follows:—(Andreossi's Histoire du Canal du Midi.)

Water raise,	= 103 feet.
Height of dam,	= 107 "
Length "	= 2558 "
Thickness at base,	= 394" "

Truly, an immense structure, and which cost an immense sum. Now how much water does that reservoir contain? Does it contain anything like the quantity of water allotted to one of the Ohio River reservoirs? Mr. Morris refers also to the reservoir constructed by William E. Morris, Esq., Civ. Eng., on the western side of the Allegheny Mountains, which has 62 feet water raise, and yet it only contains 466,000,000 cubic feet. It would require 53 *such reservoirs* to fill *one* of the size proposed by Mr. Morris.

With facts like these, it is not difficult to arrive at quite a different conclusion as to the facility of finding on the tributaries referred to, the elements necessary to sustain Mr. Morris in his assumed data. It seems to be tolerably clear, that if dependence is placed upon reservoirs on the tributaries, that a much greater number of reservoirs of much smaller capacity must be adopted.

Leaving the consideration of reservoirs on the tributaries, let us turn our examination to the main rivers, and test the results likely to be attained from dams of 100 feet height thrown across them where they are

navigable—navigable in the ordinary adaptation of the term, for example, below the Virginia State line on the Monongahela, and below Olean on the Allegheny. We will take the Allegheny river immediately above Franklin; of course there is no question here, respecting the sufficiency of the drainage; and a reservoir would be different from the proposed reservoirs upon which Mr. Morris bases his calculations in this; that draining a much larger area of country than would be sufficient to fill it, it might, to a *certain extent*, be employed as suggested by Mr. Ellet, as a regulating reservoir.

Above Franklin, the river has a fall of about 3¼ feet per mile. A dam 100 feet high would back the water about 30 miles. The principal streams flowing in on this distance, are Oil Creek, about 7 to 8 miles up, and Tionesta, about 25 miles up. The pool would be about 75 feet deep at the mouth of Oil Creek, and 17 feet at the mouth of Tionesta. It might back up Oil Creek about 15 miles to Titusville; and up the Tionesta not over two or three miles. It will also flow up a number of smaller tributaries, but not generally very far, on account of their rapid fall. We will take liberal dimensions representing the sloping or descending river valley that the pool is to cover, and assume that it shall average

500 feet	wide,	50 feet	deep,	River.
500	"	30	"	Bottom land.
90	"	15	"	Slopes.
150	"	25	"	"

on the whole distance of 30 miles. This would give in round numbers for the main valley 7,043,840,000 cubic feet; allowing on Oil Creek valley half the average area given on the main stream with half the length, it would give quarter, or 1,760,960,000 cubic feet; the flow up Tionesta would be in round numbers, say 50,000,000 cubic feet. Above the Tionesta the flow in the tributaries would be comparatively trifling, and between Oil Creek and Tionesta, the streams are short and the back-water would not extend very far, but, allowing even one-third as much as in the main valley, it would give 2,337,980,000 cubic feet. The sum would be 11,202,780,000, or considerably less than half of the quantity assumed for one of the large reservoirs proposed, say in round numbers just half.

A second dam thrown across the main river at the upper end of the pool, would, if raised 100 feet, flow to within about 10 miles of Warren. The *two* might possibly contain 25,000,000,000, the quantity required for one of the proposed large reservoirs. Immediately above Warren, a third dam of 100 feet height might be placed; and as the fall in the river is there about 4⅓ feet per mile, it would flow back about 23 miles to the vicinity of Indian Village, and would contain not exceeding three-fourths of the quantity due to the lower dam.

A fourth 100 feet dam, located at the upper end of the third pool would reach to within a few miles of Olean, and might contain about the same as the third. The capacity of the four would be equivalent in round numbers to 43,750,000,000 cubic feet, or about one and two-thirds of a single large reservoir of 25,000,000,000 described by Mr. Morris.

The entire drainage above Franklin, is in round numbers 4000 square miles, and allowing 12 inches per annum as the available surface drain-

age, the total quantity would be 111,513,600,000 cubic feet, or a little more than three and a half times the capacity of these four great reservoirs. This shows most strikingly the immense bulk of water to be dealt with. Here are four enormous reservoirs, covering one hundred and six miles in length of the main Allegheny River, which will probably contain less than enough to fill *two* such reservoirs as are used in Mr. Morris's calculations.

If the 100 feet dams were placed in the Allegheny River below Franklin, they would create more extensive pools, at the same time the damage to property would be greater. Still one above Brady's Bend, which would back up the Clarion River some miles, would probably contain considerably more than either of those suggested higher up the Allegheny.

Let us now turn to the main Monongahela below the Virginia State line. It will perhaps be admitted, that it is not feasible to build a dam of 100 feet high at any point below Brownsville, for the reason that from the present low water surface at Brownsville to the Ohio River at Pittsburgh, the *total fall* is only 36 feet. If erected just above Pittsburgh, it would therefore raise the water 64 feet at Brownsville, and 82 feet at the mouth of the Youghiougheny. It would destroy so many and such large interests, that we think it may fairly be considered to be out of the question.

The fall between the Virginia State line and Brownsville, 35 miles, is 42 feet. A dam 100 feet high at Brownsville, would therefore flow back about 25 miles into Virginia, and make a depth of 58 feet over the river bed at the State line. Assuming that in the whole distance of about 67 miles, the pools along the main valley should average 800 feet with a depth of 40 feet, and that as much more (which is deemed liberal,) would flow back along the tributaries, the entire pool would contain 23,654,400,000 cubic feet, or say, in round numbers, enough to fill *one* of the proposed large reservoirs.

The writer believes that with the four dams on the Allegheny, and this one as described on the Monongahela, properly managed, a constant flow of not less than 5 to 6 feet could be maintained in the Ohio River at Pittsburgh and at Wheeling; and further may add, that ever since he first roughly tested Mr. Ellet's theory, his opinion has been, that if the river is ever to be maintained at a comparatively steady stage of navigation—that is, constantly above some given number of feet in the channel, without dams on the main Ohio, it would be by means of a *few dams* on the main rivers, in preference to many reservoirs near the heads of the streams, so far as *first cost in building dams* would be concerned. But he has always apprehended that great practical difficulties would attend the carrying out of the plan in either case—that is, either with the few great dams on the main rivers, or the numerous small reservoirs higher up. The present approximate investigation, as it may be called, tends to confirm this opinion.

It may be remarked in this place, that the theory that these large dams may be made to constitute a part of a regular slackwater navigation, as suggested by Mr. Ellet, is certainly fallacious. They may be made to form a part of a descending navigation. On a little reflection it must strike every one, that so soon as a few feet should be drawn down from

the surface of one of these dams, it would leave the upper end of the pool bare, except so far as *a flow* of water might be kept up by water drawn from the dam above. It would create a slackwater of a peculiar character, and require a peculiar and novel arrangement for locking rafts, arks, &c. from a pool which at different periods of the season, would present a variation of nearly one hundred feet in its height of surface. Such arrangement, whatever it may be, would, without question, be regarded as inadmissible on the main Ohio, or on any part of the Allegheny or Monongahela rivers, maintained, or desired to be maintained, as a respectable slackwater for ascending and descending trade.

Mr. Morris, in the Appendix to his paper before alluded to, referring to high dams and the anticipated difficulty of accommodating the lumber trade, &c., remarks "once collected within the pools of the reservoirs, both logs and lumber would be floated from them *through the reservoir dams*, at periodic seasons by means of substantial contrivances, which any skilful engineer charged with these works will know how to plan, construct, and operate with entire success." We know not what particular arrangement may have been in view; but if any plan could be devised satisfactory to those interested in the descending navigation of the Allegheny and Monongahela, which would dispense with the *lockage* at the high dams, it would greatly strengthen the *reservoir plan*.

Mr. Morris has given an estimate of the cost of one of the proposed large reservoirs, which does not however include anything for locks. His estimated cost "for one dam is $2,000,000. Total for the six artificial lakes, say 12,000,000 dollars." This may be quite enough for the number and kind of dams assumed, but is it enough to secure the quantity of water estimated to be stored? The estimate is based on the general idea entertained by him that those large reservoirs could be established on the *creeks* towards the heads of the streams, the damages being estimated at only $10 per acre; whereas, it is obvious that such high dams cannot be profitably located there on account of the rapid fall encountered. And Mr. Ellet says in his paper published in 1849, in the Appendix, "There is no difficulty on any of the principal tributaries of the Upper Ohio, in obtaining reservoirs capable of holding from twelve to twenty thousand millions of cubic feet. It can scarcely be doubted that *twelve* or *fifteen* sites for dams may be selected capacious enough to hold all the excess of water, and equalize the annual discharge so nearly that the depth may be kept within a very few feet of an invariable height." The writer apprehends that surveys will establish a very different result.

But waiving for a moment the consideration of the cost of storing up water by means of high dams or great reservoirs, if we take the Conemaugh reservoir before mentioned, as a criterion of the cost of procuring water, we have 466,000,000 cubic feet, costing $166,000. The quantity estimated by Mr. Morris being 150,000,000,000 cubic feet, at the same rate per cubic foot it would be $53,410,000, and it would require 321 reservoirs of similar size.

But in the case of the few large dams on the main rivers, the cost, including locks for the 100 feet lift at each dam, would probably be much less. The actual first cost is, however, not the only important question. Some adequate and satisfactory arrangement for the passage of the im-

mense descending lumber trade must be provided. Can it be accomplished with dams of 100 feet height, either by means of locks, or in any other manner, in such a practical shape as to be satisfactory to the parties interested? If not, then this objection will be fatal to the plan of placing these immense structures on the main river Allegheny.

In the absence of any definite suggestion respecting the *mode* of overcoming this great practical difficulty, the advocates for artificial reservoirs may be obliged to fall back upon the original proposition of Mr. Ellet—numerous smaller reservoirs towards the sources of the tributaries. Then if we take but one *half* the cost per cubic foot of water, as just calculated, it would amount to $26,705,000.

Is it reasonable to presume that the quantity designated, 150 thousand millions of cubic feet would cost much less?

There can be no doubt that there are several advantages appertaining to large reservoirs on the main streams, where the retained water is to be used for navigation purposes, in commanding surplus water at a lower cost per cubic foot, and in the saving of evaporation. The loss by evaporation from the greater surface of numerous small reservoirs, and on many miles during its flow from those distant points to Pittsburgh would be very considerable, and should not be overlooked in any future critical examination. They could also be more cheaply managed than numerous smaller ones.

Three hundred and twenty-one reservoirs, each as large as that on the Conemaugh, allowing an available drainage of 12 inches depth, would require for each, an area of territory of 16·7 square miles, and an aggregate of 5360 square miles. This would bring into requisition "sites in or near the elevated country," but it will be impossible to avoid encountering in nearly every instance, much more rapid fall than "four feet per mile," and a much less average width of valley than "three-fourths of a mile;" and no where will the depth of a reservoir average half the greatest depth at the dam. Nearly all the head waters within five, and most of them within ten miles of their sources fall 30, 40, or 50 feet, or even more per mile.

It is proposed to examine next, the effect of great reservoirs on the main tributaries or rivers, in connexion with high floods, &c.

Great Reservoirs; their Control of Great Floods.

We proceed to examine the effect of reservoirs on the Allegheny River, &c., in connexion with the great freshets of the Ohio River.

Mr. Ellet has suggested, and to a certain extent elaborated the idea, that it is entirely practicable at an allowable and reasonable cost, to construct large reservoirs on the main branches of the Ohio, or on the Allegheny and Monongahela rivers, which shall give us complete practical control of heavy freshets. He says, "It is not asserting more than the measurements presented in this paper will justify, when it is maintained that it is entirely in the power of man to control all the waters of the Mississippi and Missouri, and compel every river to flow with an even current, from its source in the Allegheny or Rocky Mountains, to its home in the ocean, forever free from the hurtful effects of floods and draughts."

"Reservoirs may eventually be made of sufficient capacity to hold all the annual excess, and make the daily flow almost entirely uniform."

"All this may be accomplished on the Ohio *for about the cost of three or four ships of the line.*" "The great and only difficulty is to overcome the cold incredulity of the public, so as to induce those in power to grant a sufficient appropriation for the completion of the first two reservoirs." The italics are in Mr. Ellet's original paper. Again, "to exercise complete control over all injurious floods, will involve a greater outlay than will be required for the effectual improvement of the navigation; but even this can be accomplished by works which will also secure to the navigation a permanent depth of *six feet, for about the cost of maintaining a ship of the line on a three years' cruise.*"

Mr. Ellet's deductions satisfied his judgment, that the records, measurements, and calculations justified these premises. Mr. Haupt, possibly, without a very critical investigation, seems to sanction to a considerable extent the same attractive idea; and Mr. Morris urges that "six artificial lakes of the size herein contemplated, could not fail to exert a *material influence* in moderating the Ohio River floods." And he introduces the name of Professor E. D. Mansfield, the accomplished Editor of the *Railroad Record*, as greatly strengthening the claims of Mr. Ellet's views to public consideration.

In order to test the question of controlling floods, we propose to go beyond the suggestions of the originator of the proposition in regard to the number of large dams to be employed; and to place the first dam at Wheeling, on the main Ohio River,* and assume that a set of dams, one backing the water to the next above, each 50 feet high are built. If we take 16 dams overcoming a total rise in the Ohio and Allegheny rivers of 800 feet, they will extend 333 miles, or to within five miles of Olean in the State of New York.

The average length of each pool will be 20¾ miles. To be liberal, we assume the average depth above the river, the bottom lands, and side slope of the hills overflowed, at 40 per cent. of the full depth at the dam, or 20 feet; and the average width of the prism of water, at 2200 feet; and add one-third to the total quantity for the flowage or backwater up the tributary side streams. The entire cubical contents of these 16 great reservoirs would thus be 103,150,080,000 cubic feet.

If we allow 12 inches out of an annual fall of 36 inches of water to be available, this would equal about *one-eighth* of all the drainage of 25,000 square miles, which is in round numbers, the area of the territory drained above Wheeling.

Such a flood as that of 1832, which raised the river at Wheeling to 44 feet, would, if continued, fill all these great reservoirs, if *empty at the start*, in three days.

A fall of *two inches* of rain on a frozen surface, would also be sufficient to fill them.

The discharging capacity of the reservoirs, designed to keep up a perennial flow in the Ohio of not less than six feet depth, according to Mr. Ellet's data is 1,164,000,000 cubic feet per day.

*We are not now considering questions of damages, but simply the effect of large dams and reservoirs on floods.

This is an immense body of water, equivalent to the entire contents of 2½ such reservoirs as that on the Western Division of the Pennsylvania Canal, which holds 466,000,000 cubic feet. That is, two and a half such reservoirs must be emptied daily, to create such flow of 6 feet.

It is obvious that these 16 reservoirs, being once filled, even with the discharging pipes purposely left open, will only begin to draw down the surfaces of the pools, when the regular natural drainage into them from the daily flow shall become less than 1,164,000,000 cubic feet; and that then the daily decrease of water held in reserve, will be only the *difference* between such natural flow and the daily discharge.

The inflow never entirely ceases; but, excluding the inflow, these 16 pools would hold enough for 88 days of six feet navigation. Adding thereto the *minimum* daily flow at Wheeling, as given by Mr. Ellet, or 207,360,000 cubic feet, it would make 16 days more, making a total of 104 days. Though it has never occurred, and it is scarcely possible that such minimum flow should continue strictly for one hundred days. Such a state of the water would present a draught far greater than any hitherto experienced in this region.

This goes to prove the capacity of these reservoirs for keeping up a six foot navigation in the river during most seasons. But does it follow, that we shall have attained to the practical command of the great floods? This is the point now to be considered; and we think it may be elucidated by a closer analysis of the important and satisfactory data published by Mr. Ellet. The records, measurements, and tables prepared by Mr. Ellet, are of such a nature that they will perhaps settle this question conclusively. These daily records of the depth of the water at Wheeling begin with 1838, and end with 1848.

Before proceeding to the further examination of these records, we may presume that it will be granted, that in the case of a freshet happening at the moment when the reservoirs should be full, they could afford no aid in controlling floods below the lower dam, assumed to be at Wheeling; or at least no material aid.

We have examined these records to ascertain what the effect would have been had the above system of sixteen dams been in operation from 1838 to 1848 inclusive.

In 1838, the floods would have overflowed all the reservoirs in March, and on every day in April the inflow was greater than the discharging capacity: and for 22 out of the 30 days it was considerably more than double. In May and June, there was no day when the inflow was not greater than the discharging capacity. In May, the freshet rose on different days, to 24, 31, 29, and 26 feet respectively; and as that flood would have found overflowing reservoirs, no portion of it could have been controlled. There was not a single day for over three consecutive months, when the reservoirs would have aided in restraining large freshets. Then followed the memorable 120 days of extremely low-water, during which period the natural flow at Wheeling, according to Mr. Ellet's tables, was 26,400,000,000, which, added to the aggregate content of all the reservoirs, would have made a total of 129,500,000,000 cubic feet. The quantity required for a continuous six feet stage through the same period, would have been

139,680,000,000 which would have left a deficiency of 10,188,000,000. There would have been a little deficiency before the commencement of the 120 days. One or two large dams on the Monongahela in addition, would have supplied the entire deficiency. It is evident, on inspection, that the 16 dams would have been sufficient to have maintained over five feet depth all the time.

In 1839, seventeen days in January and eleven days in February were not recorded. We cannot therefore decide with certainty that the reservoirs would have been filled then. They would certainly have filled in March, if not before; and they could not have been materially drawn down until the first week in July. In March, April, May, and June, they could not have assisted in restraining heavy floods had any occurred. As it appears, the highest freshet was on June 16th, 23 feet. But during this period of nearly four months, the river was constantly liable to receive a first class flood.

In 1840, the record begins with January 22d. We have no present means of knowing what proportion would have been in the reservoirs on that day, and will not surmise. From that date until the end of the month, the inflow was very much more than the discharge would have been. By the middle of February, the reservoirs would certainly have been full. The first heavy flood of that month, which rose to 38 feet, might have been slightly held back, unless the flow before January 22d was heavy. But in any case, the reservoirs would have been *nearly full* before the commencement of this heavy flood; whilst the second great flood of the same month, on the 25th and 26th, which rose to 36 feet, must have found the reservoirs *largely overflowing*. Even if the reservoirs had been absolutely empty as late as the first day of February, which we know could not have been the case, they would have been filled before the 18th, before the beginning of the second flood. The flood of May 1st to 5th, which rose to 28 feet, would also have come upon overflowing reservoirs.

It is singular, that this marked exemplification of the inutility of such reservoirs as a means of controlling floods, should have escaped the observation of Mr. Ellet.

In 1841, the record begins on January 10th, when the depth at Wheeling was 22 feet. The average depth for the remaining 21 days of that month, was 14 feet, which would have half filled the reservoirs had they been empty January 9th, which, of course, could not have been the case with the water at a flood of 22 feet on the 10th. There might, or might not have been a chance of restraining, to some extent, a flood in February. In March, when the freshet of the 23d to the 31st came, the reservoirs would have been drawn down a mere trifle, and this flood which rose to 34 feet on the 29th might have been very slightly checked. From that time until the latter part of May, the reservoirs would have continued to overflow. In December, they would have been again overflowing. But during all the months of February, March, and April, or most of the time, they could not have aided in restraining floods. The highest water in April was 28 feet, and in May 20 feet.

In 1842, the reservoirs would have been overflowing in the beginning

of the year, and would have so continued until about June; offering during those five months, no protection whatever against the effects of floods below Wheeling. And *there were* freshets: in January, 22 feet; in February, two of 28 feet each; in March, 26 feet; in April, two of 18 feet each; and in May, 19 feet.

In 1843, from January 1st to 31st, there was enough inflow to fill the reservoirs; and as they would have been at least half full at the close of 1842, they would have overflowed by the first of February, and from that time until the latter end of June, nearly five months, they would not have ceased to overflow; and during all that period could have rendered no service in arresting great freshets or any freshets. The inflow during the month of April was remarkable; showing an average depth of 19·4 feet for the whole month; sufficient to have more than twice filled the reservoirs; *the whole of which* would have passed along on the top of overflowing pools. In December, the reservoirs would have been again overflowing. The highest waters were in March, 18 feet; April, 20 and 27 feet; May, 18 feet; June, 19 feet.

In 1844, throughout January, the reservoirs would have continued to overflow. In February there would have been a slight draught upon them taking about 1½ feet from the surface. In March, they would have overflowed; and they would have continued overflowing until August, when they would have been partially drawn down to keep up the required flow for August, September, and October. In November and December, they would have again filled. Thus in April, May, and June, the reservoirs could have been of no avail in restraining floods. It happened that there was no large flood in 1844.

In 1845, commencing with full reservoirs, they would have continued to overflow until near the middle of April, affording during this period of three months, no assistance in holding back freshets. The highest flood occurred March 12th, when it rose to 24 feet. This was a remarkable year along the Ohio Valley; for although it presents much the smallest total yearly flow, so that it would have made a uniform depth throughout the year of but 7·03 feet, yet it happened to be so equally distributed, that the reservoirs we are now considering, would not at any time have been emptied. The lowest average depth at Wheeling for a month, was 2·82 feet, in August; the next lowest was 3·4 feet in September. The floods were moderate, rising to 21 feet in January, and 24 feet in March; both of which would have come upon overflowing reservoirs. In December, the reservoirs would have been about half full.

In 1846, the reservoirs would have filled in January, and remained full until June, when they might have been slightly drawn upon, (though the average flow for the month of June was fully up to the quantity required for a 6 feet stage of water.) In July, they would have been overflowing. In November and December, they would have been largely overflowing. In December, alone, more than *four times* the discharging capacity would have drained into the reservoirs. On the 15th of March of this year, there was a heavy flood, which rose to 35 feet at Wheeling; but the reservoirs must have been overflowing when it came. In December, there was a flood of 28 feet, with the reservoirs overflowing before it commenced. At the close of the year, all the reservoirs would have been largely overflowing.

In 1847, a flood of 28 feet occurred, January 3d, which would have been on the top of largely overflowing reservoirs; and they would have continued to overflow for four months or more, until the latter part of May, when a *very* slight draught would have been made, leaving them overflowing again in June. In October, they would have filled again. In October, more than *three times* the discharging capacity flowed in; in November, nearly *three times;* and in December, over *six times.* In addition to the January flood, there was one in February of 27 feet; one in March of 27 feet; one in November of 32 feet; one in December of 38½ feet; not one of which could have been retarded or controlled by means of the reservoirs. In the single month of December, the inflow was more than enough to have filled all the reservoirs *twice*, had they been empty on the 30th of November, and yet we see that they must have then been full.

This was another remarkable season. The average depth for the lowest month, September, as recorded at Wheeling, was never less than 4 feet; the actual lowest water being 2¼ feet for three days. The drainage this year, would have filled all the reservoirs more than *ten times* could they have been emptied each time. The highest flood recorded in the eleven years, would have swept over the top of overflowing reservoirs.

In 1848, starting with overflowing reservoirs, they would have continued overflowing until June, with an almost imperceptible draught upon them in June, which would have been supplied again in July. Before the 20th of December, they would again have been filled to overflowing. In January, there was a freshet of 26 feet; in March, one of 18 feet; and on the twenty-fifth of December, another of 26 feet; all of which would have found the reservoirs full, and which, therefore, could not have been restrained. In December, the inflow was equal to *five times* the discharging capacity.

Thus the record for these eleven years proves, that although in a few instances, floods might have been in part checked by the operation of the reservoirs, yet in the great majority, including the *very heaviest* floods, the freshets would have passed along on their ocean bound course entirely uncontrolled. Out of thirty-two floods recorded, there were but *two* or three when the reservoirs would not have been full.

It is a fair query then, whether instead of being advantageous as means of controlling floods, they would not have been positively injurious? According to the theory of those who oppose the lock and dam system, the depth of the river below the lower dam in time of flood, would be *greater* than it would be without the dams, and this would be further increased according to Mr. Morris's suggestion, in consequence of the prism of water, six feet deep, which would constitute the lowest stage of the river. The inference would be, that the freshets below the lower dam, in a large majority of the floods, as recorded, would have been *greater* with the reservoir system in operation, than with the river left in its natural state.

It may be argued, in discussing this branch of the subject, that the venting capacity of the dams could be made greater than barely sufficient to discharge the quantity required for a six feet navigation, the capacity allowed in the foregoing examination. True, but in reply it may be

stated, that in actual practice, the real discharge in different stages of water in the pools, would *require* much more extensive apparatus than would be barely sufficient with full pools; for the reason that when they should be reduced considerably, the pressure at the pipes would be correspondingly reduced, and the discharge proportionally decreased; so that when the pools should be drawn down half the depth, or 25 feet at the dam, double the capacity of discharge would be necessary; and when three-fourths drawn down, four times the capacity, and so on in proportion as the pools should be emptied. The apparatus, with only 10 or 12 feet of pressure, would necessarily be very extensive.

But again, should it be admitted that even very much greater discharging arrangements could be employed, than any hitherto alluded to by the friends of the reservoir system, so as to give control over a larger proportion of the heavy freshets, it must be recollected, that there would be a limit to this also. We cannot overlook the *fact*, that no human foresight can divine when it would be safe to draw down the reservoirs for the purpose of *being prepared to catch a great flood*, in view of the other objects of their construction, namely, *storing up* water to be used in time of need.

Let us glance at this in another aspect; although the quantity of water calculated as stored up in these 16 dams of fifty feet height, flooding over 333 miles of a great river valley, an average depth of 25 feet above the natural surface of the stream, is but two-thirds of the quantity assumed by Mr. Morris in connexion with the six reservoirs designated by him, yet the field of operation is much more advantageous on the main river, than it would be on the smaller tributaries, for securing through the year a given quantity of water; irrespective of damages to property, towns, cities, and navigation interests. These river pools or reservoirs, would be in a much better geographical position for controlling large freshets than the reservoirs on the tributaries; because on the tributaries if they were so located as to command only about a sufficient area of territory to fill them but once during a dry season, it would not be safe to discharge *any portion* of their contents, except for *one* object, namely, to aid in keeping up the flow of the Ohio River to 6 feet depth during the dry portion of the season. If they should be emptied for the purpose of acting as reservoirs to *catch floods*, or to break the force of contemplated or expected floods, the records show that *great risk* would be run of having no water of consequence in the reservoirs when it might be *essential* for sustaining the navigation. The periods of heavy rainfalls are so entirely irregular, that the judgment of man could not regulate and bring into harmony the two things desired, upon any data that we know of or have assumed.

In order to obtain any practical, reliable control of freshets, much more extensive, and much more costly constructions would be absolutely necessary, than all that we have been considering.

It would appear, then, that Mr. Ellet's suggestions, though beautiful and desirable, are not, as he has announced, "*easily and cheaply practicable.*" That on the contrary, in regard to the great freshets on the Ohio River, to control them practically, would require an expenditure vastly greater than he has estimated, and would involve the *destruction* of the

present navigation of the Allegheny River; which is entirely too important to be ignored; and would come into conflict with thousands of citizens, whether in the shape of immense dams on the main rivers, comparatively few in number, or reservoirs on the tributaries, smaller but greatly more numerous. But the writer does not by any means rest the question now under consideration wholly upon this latter suggestion. Nevertheless, it is a practical matter to be practically thought of.

(To be Continued.)

Railway Accidents in 1856.*

By the report of Captain Galton, of the Railway Department of the Board of Trade, of the accidents which occurred on and by the railways of the United Kingdom, during the past year, 1856, we learn the following particulars, which for the convenience of our readers we place in a tabular form :—

ACCIDENTS IN 1856.

	Killed.	Injured.
1st. Passengers, . . .	27	298
2d. Servants of Companies or contractors employed on railways, .	142	80
3d. Persons neither passengers nor servants of Companies, .	112	16
	281	394

Thus, from the three classes named, 281 persons were killed in 1856, and 394 injured.

But let it not be supposed that the railways are chargeable with having done all this mischief, small though it be in relation to the numbers carried and employed in the year. Some committed suicide, many were trespassers, others would cross the railways when they had no business to do so, others fell victims to their own carelessness, &c., &c. The real extent of damage to the public by the railways is comparatively very small. Indeed, on many English lines no accidents whatever have occurred during the past year, and in the language of Capt. Galton—"Upon certain lines no accidents have occurred during the last *six years*." It is also most gratifying to find—"The number of accidents into the causes of which your lordships deemed it desirable to institute inquiries, is also smaller than that for the preceding three years. It may, therefore (continues Captain Galton), be safely assumed that the railways have been worked with a greater degree of care than in former years."

We have said, on the authority of the Government reporter, that 27 passengers were killed in 1856 on the railways of the United Kingdom. But 27 were not killed *by* the railways. Only eight were killed by the railways, that is, "from causes beyond their own (the deceased passen-

* From Herapath's Journal, No 923.

gers') control." 19 of the 27 were killed "from want of caution on their own part." If a passenger from his own carelessness gets killed on a railway, we cannot blame the railway any more than the canal into which a person tumbles, and thereby loses his life. It follows that the railway Companies are justly blameable for the loss of only eight passengers' lives in the course of last year, and yet in that year about 130 millions of passengers were carried over a length of railway of 8500 miles; that is, but one passenger out of 16¼ millions conveyed, met his death by the railways, a result which Lord Campbell himself must feel thankful for.

An elaborate table is furnished of the accidents since 1850, which we condense into the following statement:—

	Mean No. of miles open.	No. of passengers conveyed.	No. of passengers killed.	Proportion to No. of passengers conveyed.
1850	6326	72,854,422	12	1 in 6,071,202
1851	6755	85,391,095	19	1 in 4,494,268
1852	7113	89,135,729	10	1 in 8,913,572
1853	7488	102,286,660	36	1 in 2,841,296
1854	7812	114,358,888	12	1 in 9,529,907
1855	8175	118,595,134	10	1 in 11,859,513
1856	8499 (say)	130,000,000	8	1 in (say) 16,250,000

The returns of the number of passengers conveyed during the second half-year of 1856 being incomplete, disable Captain Galton from giving the exact proportion in that case, but it is perfectly clear (to us) that the number for the whole of 1856 can hardly fall short of 130 millions. As about 118½ millions were the number carried in 1855, it might be thought 130 millions in 1856 are an excessive calculation. But we can give reasons to show that it is not so. 1854 increased over 1853 by more than 12 millions. And 1853 also increased over 1852 by more than 12 millions. 1855 did not increase over 1854 to the same extent, owing to special and extraordinary causes. We have the return for the first half of 1856, and this shows a larger increase over the first half of 1855, than the first half of 1854 does over the first half of 1853. If the second half of 1856 progressed as did the first half of 1856, there would be between 132 and 133 millions, as the number carried in 1856. Therefore we think we may safely say the number is 130 millions, or about 11½ millions increase over 1855.

Well, eight passengers killed by the railways in 1856, out of 130 millions carried, or 1 in 16¼ millions! Let the fact be well known and strongly impressed on the minds of those fearful of railway traveling. Let it be known that it is no uncommon thing to find that no fatal accident has occurred on a long line of railway in the last six years, notwithstanding that millions of persons have been annually conveyed over it at high speeds. Let it also be borne in mind, that, averaged over the whole length of railways, the infinitesimally small extent of accident that has occurred in the past year is the result of evils that may be cured, of matters of detail in management that may be remedied, and we think any candid person of ordinary capacity must admit, that the railway sys-

tem is in itself as near an approach to perfection as anything in this world can be. If we were all as perfectly sound in our minds, and as perfectly good in our hearts, as the railway system is safe as a means of conveyance, we should be infinitely better than we are—yet the fashion is to speak with horror of the extent of fatal railway accidents, and millions annually are doubtless deterred from enjoying the pleasure of traveling in fear of the *risk* of danger in it!

Captain Galton observes—"It is worthy of remark, that none of the accidents which occurred during 1856 were due to the permanent way being in a really defective condition. The immunity from accident on this ground appears to be attributable to the great attention which has been given by engineers to the subject of permanent way, and *to the introduction of the fished joint*, and of other improved methods of connecting the rails at the joints." Respecting "facing points," it is remarked—"The use of facing points on railways has always been a fertile source of accident, and the additional experience which is daily acquired on the subject shows that the self-acting principle cannot be safely trusted on a main line of railway, but that facing points, when passed by trains at any speed, should always be held, pinned, or locked in position."

Collisions of trains, resulting, of course, from carelessness, are the principal causes of railway accidents—passenger trains running against trucks and goods trains or other passenger trains. But every year sees them diminishing; the system of management improving. "The railways have been worked (in 1856) with a greater degree of care than in former years." In course of time, an accident on an English railway, we trust, will be regarded as a most extraordinary occurrence, and a person will no more apprehend danger while sitting in a railway carriage, and traveling at the rate of 40 miles per hour, than in leisurely walking along the streets of London. Freedom from accident, fatal especially, would not only be a mercy and a boon to the traveling public, but would so greatly enlarge the extent of traveling, that the railway companies would, in a pecuniary point of view, reap an incalculable amount of benefit from it. There is no doubt that fear prevents vast numbers from traveling, although it is so far unfounded, that in the United Kingdom, for every 16¼ millions of persons conveyed, only one loses his life—a fact that completely establishes the extremely exceptional character of fatal accidents on the railways of this country. The orange peel in the streets of London, doubtless, causes more loss and damage to the lives and limbs of Her Majesty's subjects, than all the railways within these her realms, though the extent of their traffic is no less than 130 millions of passengers in a year. The public in point of safety, as well as economy, have gained immeasurably by the introduction of railways in the room of the stage coaches.

AMERICAN PATENTS.

List of American Patents which issued from May 12th, to May 26th, 1857, (inclusive,) with Exemplifications.

MAY 12.

65. For an *Improvement in Wrought Iron Plate Railroad Car Wheels;* G. W. Alden, City of New York.

Claim.—"Constructing the tread and flanch of the wheel, and connecting the same with the hub or centre thereof, by the combination of the two plates, and uniting in the flanch of the wheel."

66. For an *Improved Apparatus for Heating and Cooking by Gas;* R. Snowden Andrews, Baltimore, Maryland.

"The invention consists in presenting hot drafts to the burning mixture of gas and air—thereby producing great intensity of heat."

Claim.—"Its tubes, hot air chamber, perforated rim, and spreading flanch."

67. For an *Improvement in Self-indicating Balance;* Z. W. and O. Avery, Bethany, Pa.

"The invention consists in applying a rolling poise to the top of the balance beam, both the poise and the beam being smooth, so as to offer the least possible resistance to the poise as it rolls out on the beam."

Claim.—"The combination of the rolling poise with the smooth beam and armature."

68. For an *Improvement in Signal Lamps;* R. P. Bailey, Niagara, New York.

Claim.—"The means employed to raise and lower the colored tubes by means of the rings and chains, so constructed and attached that one tube or cylinder may play or move up and down within the other, and independent of each other, thereby allowing the different colors to be changed without obstructing each other."

69. For an *Improved Rotary Shingle Cutter;* Wm. Bevard, St. Louis, Missouri.

Claim.—"The combination of the automatic feeding apparatus, with the rotating shingle machine, and also the curved knife when combined."

70. For an *Improved Stitch for Sewing Machines;* C. F. Bosworth, Petersham, Mass.

Claim.—"Forming a stitch by passing a loop of thread through any material to be sewn, and passing a loop of thread taken from the opposite side through it, and fastening the last formed loop by passing the body of the thread upon the same side entirely through the said loop."

71. For an *Improved Portable Barrack;* M. F. Brantingham, Sangamon Co., Illinois.

Claim.—"The combination of separate and detached pieces of material, so as to form a barrack which can be used for the protection of crops from the weather, and which can be readily separated again for removal from place to place, and then re-constructed."

72. For an *Improvement in Corn Planters;* John Broughton, City of New York.

"The invention consists in having a flexible tube, sack, or seed chamber, constructed of muslin or any suitable cloth, or any woven fabric, the lower end of said tube being connected to a distributing device, and the upper end connected to a plunger which passes through the tube or sack, so as to form a light, simple, durable, cheap, and efficient implement."

Claim.—"The distributing device formed of the block having the opening made longitudinally through it to receive the plunger, having the recess made in it; the block being provided with the chamber, slide, and tube, when said distributing device, or its equivalent, is used in combination with the flexible tube or sack."

73. For an *Improved Apparatus for Roasting Meat;* John G. Brown and John P. Derby, South Reading, Massachusetts.

Claim.—"A new article of manufacture, consisting of a pan with the handles, sockets, the movable standards, ratchet wheel, pawl, and spit, for a roasting apparatus."

74. For an *Improvement in Seed Planters;* John H. Bruen, Penn Yan, New York.

Claim.—"The tube, in combination with bar and disk distributor."

75. For an *Improved Mode of Overcoming the Windage in Fire Arms;* Ambrose E. Burnside, Bristol, Rhode Island.

Claim.—"1st, The cap or patch which covers the ball or shell, said cap not being permanently attached to the ball. 2d, The enlarging of the cannon ball or shell, after it reaches the enlarged chamber of a cannon by means of a cap or patch of soft expansive material, such as leather, malleable metal, or the two combined, in order that the ball and cap together may be some larger than the bore, and therefore prevent windage in passing out of the bore."

76. For an *Improvement in Machines for Making Lozenges;* Oliver R. Chase, Boston, and Silas Edwin Chase, Charlestown, Massachusetts.

Claim.—"The combination of the reducing rollers, the directing and gauging rollers, the endless aprons, and the sugar receptacles formed by the endless aprons, the two rollers and the side plates or timbers of the frame, the whole being for the purpose of reducing the dough or mass of paste to an equal thickness, and applying strata of powdered sugar or material to its flat surfaces. Also, the striker and its operative mechanism, as combined with the cylinder, and made to operate in connexion therewith, not meaning to claim a roller as combined with the cylinder for simply forcing the dough into the cutters by pressure—but a contrivance like the striker, which forces the dough into the cutters, and the latter through the dough by a blow or percussion. And in combination with the cylinder of cutters and the striker, a flexible or elastic roller as applied and used, and for the purpose of finishing the surfaces and edges of the lozenges after the action of the striker has taken place. And, in combination with the rotary series of cutters, pistons, and scrap clearers, and their operative mechanism, the two endless aprons, for respectively receiving the waste or scraps, and the lozenges, and conveying them out of the machine."

77. For an *Improved Machine for Cutting Match Splints;* Thomas Cook, City of New York.

Claim.—"The arrangement of the block carrier so as to have the two motions, whereby the splints may be cut by stationary cutters. Also, the method of supporting the block in the box by the longitudinal pressing springs, in connexion with a feed follower acting in conjunction therewith."

78. For *Artificial Honey;* Zenas Corbin and Gideon Marlett, Syracuse, New York.

Claim.—"Artificial honey composed of the enumerated ingredients, or their equivalents, combined with each other."

79. For an *Improvement in Horse Shoes;* David Cumming, Sorrel Horse, Penna.

Claim.—"The false bottom or holding plate, when used in connexion with the movable calks."

80. For an *Improvement in Hook Temples for Looms;* Warren W. Dutcher and Geo. Draper, Milford, Massachusetts.

Claim.—"Combining with the temple and its spring, a lever, or its equivalent, that just before the lay beats up it shall, by its action on such lever, cause the temple to be advanced on the cloth or towards the reed, in order that when the lay may move in the opposite direction, the spring of the temple shall draw back the selvage of the cloth so as to straighten the warp threads thereof."

81. For an *Improved Method of Connecting the Check-piece to the Mouth-piece of Bridle Bits;* Kasson Frazer, Syracuse, New York.

Claim.—"Constructing check-pieces of bridle bits by making a neck at each extremity within the ball of the mouth piece, and securing the same therein by means of filling the chamber around the necks with metal or other composition."

82. For an *Improvement in Corn Huskers;* E. F. French, Franklin, Vermont.

Claim.—"The combination of the endless aprons and rollers, two or more, covered with india-rubber or other elastic material."

83. For an *Improved Mode of Constructing Portable Houses;* Daniel Fitzgerald, City of New York.

Claim.—"1st, Uniting the roof in sections to render it portable. 2d, Cutting down a space in the sill, and tenoning each side so that the door frame will set close down and be held firm."

84. For an *Improvement in Semi-rotative Steam Engines;* C. B. Gallagher, Allegheny City, Pennsylvania.

Claim.—"The arrangement of means for producing continuous rotary motion from the semi-rotative piston of the engine."

85. For an *Improvement in Needles for Sewing;* Benjamin Garvey, City of N. Y.

Claim.—"A sewing needle having a self-closed eye with a slit leading outwardly, and made to terminate at a point more or less remote from the eye, through which slit the thread may be forced into the eye."

86. For an *Improved Nail Plate Feeder;* John C. Gould, Boonton, New Jersey.

Claim.—"1st, The feed rod, the forked spring arm, in combination with the feed-rod. 2d, Placing the ratchet cam on an arm, for allowing it to have a forward and backward motion, also a vibrating motion for the purpose of accommodating itself to the movement of the nose-piece, and for revolving the same."

87. For an *Improvement in Hemp Brakes;* J. Locke Hardeman, Arrow Rock, Mo.

Claim.—"The employment, in combination with a stationary platform composed of bars *q*, of a pair of curvilinear moving platforms composed of bars *c, e.*"

88. For an *Improvement in Seed Planters;* John Haselton, Orford, New Hampshire.

Claim.—"The arrangement of roller and sliding frame."

89. For an *Improvement in Propeller Blades;* George Hibsch, Buffalo, New York.

Claim.—"Constructing propeller wheels having blades."

90. For an *Improvement in Harvesters;* Moses G. Hubbard, Penn Yan, New York.

Claim.—"The employment of the cogged segment attached to the pole rocker, in combination with the worm, for the purpose of elevating and depressing the frame."

91. For an *Improvement in Presses for Cotton, &c.;* Henry Hughes, Port Gibson, Mississippi.

Claim.—"The employment of a grooved plate, having a horizontal or other formed surface, with grooves thereupon for the purpose of operating the levers."

92. For an *Improved Process for Treating Raw Cotton;* Julius C. Hurd, Medway, Massachusetts.

Claim.—"The treatment of cotton by bleaching previous to picking or carding it, for the purpose of removing the motes and trash."

93. For an *Improvement in Harvesters;* Moses G. Hubbard, Penn Yan, New York.

Claim.—"The combination of the shifting fork, short crank, and handle, for throwing the machine out of, or into gear."

94. For an *Improvement in Folding Bedsteads;* James A. Johnson, Antrim, Ohio.

"The invention consists in constructing a model bedstead, having hinged joints, so arranged that the bedstead can be thrown into several convenient and accommodating positions."

Claim.—"The accommodating brace, with the stay block, and hinged jointed rails and posts, for the purpose of forming an invalid, or other bedstead, as required, easily removed without being taken apart, either whole or in part."

95. For an *Improvement in Bed Bottoms;* J. F. Keeler, Cleveland, Ohio.

Claim.—"The eyelets and the cords, with or without the springs, connected with the rails, and arranged in relation to the slats."

96. For an *Improvement in Coal Stoves;* John C. Keller, Philadelphia, Penna.

"The invention consists in a new method of introducing hot air into the fire chamber of a stove, above the coal by means of tubes."

Claim.—"The arrangement of the perforations in the cylinders, situated opposite to each other, so that the current of air entering shall be divided and heated by passing half around the cylinder, previous to entering the groove through the perforation."

97. For an *Improvement in Blacksmiths' Striker;* Hartwell Kendall, East Dorset, Vermont.

Claim.—"The use of the springs."

98. For an *Improved Mortising Chisel;* George P. Ketcham, Bedford, Indiana.

"This invention relates to an improvement by which the mortise is cut and cleared of chips or blocks at one and the same stroke of the chisel."

Claim.—"The employment of the divider and the shoulders."

99. For an *Improved Joiners' Plane;* Benjamin I. Lane, Newburyport, Mass.

Claim.—"The sliding plate, with bar attached, through which the screw-rod passes, the plate being operated by the wedge and screw-rod. Also, in combination with the plate and bar, arranged and operated as shown, the screw-rod applied to the iron, and connected with the plate and bar, whereby the iron may be adjusted or 'set' with facility, and also secured firmly in its proper position within the plane."

100. For *Improved Cartridges;* Edward Lindner, City of New York.

Claim.—"A cartridge, in which an annular wad and the casing to contain the powder are formed of the material, and secured thereto by the act of casting the ball."

101. For an *Improved Machine for Boring Flue Sheets of Steam Boilers;* Sylvanus V. Lowe, Reading, Pennsylvania.

Claim.—"The attachment and use of mandrel, when constructed, arranged, and adapted to this purpose only."

102. For an *Improvement in Cleaning Guard of Grain Elevators;* George Mann, Jr., Ottawa, Illinois.

Claim.—"The sliding grate or screen, having its lower part curved or bent, and used in connexion with the slide."

103. For an *Improvement in Machines for Engraving Cylinders;* Robert Muckelt and Wm. Rigby, Salford, England.

Claim.—"1st, The levers and the parts therewith, varying the relative proportion between the original design and that produced when applied to machinery for engraving designs on cylindrical or other surfaces. 2d, The ruler or guide plate."

104. For *Improved Blasting Powder;* Antoine Murtineddu, Marseilles, France.

"The invention consists in a new composition of matter, which, when ignited, will not explode, but will give out such a great amount of heat that it will blast rocks with great ease and without danger."

Claim.—"The composition of matter."

105. For an *Improved Joiners' Bench Strip;* Charles T. Pearson, Chelsea, Mass.

Claim.—"Attaching the strip to the slides, which are fitted in dove-tail grooves in the bars, the slides being provided with pawls, against which springs act."

106. For an *Improvement in Locks;* Stuart Perry, Newport, New York.

Claim.—"Operating the key, tumblers, or slides of locks, by such an arrangement of parts within the lock, that every time it is worked said tumblers or slides must, in relation to their furrings or guides, be moved by the key stem, or its equivalent, beyond the limits to which the key-bits move them, and sufficiently beyond and with such differing distances among themselves, beyond that the limits of their full movement shall be entirely different from the limits of their partial movements in the same direction by the key-bits, thus producing false clues, and effectually destroying all true clues for picking in the ways."

107. For an *Improved Coal Cracker;* Townsend Poore, Carbondale, Penna.

"The invention consists in the combined use of the rocking crusher with the grated hopper, part of which hopper is stationary, and part movable, and working in connexion with the crusher."

Claim.—"The combination of the rocking cracker with the fixed and swinging gratings."

108. For an *Improvement in Devulcanizing India-Rubber;* Conrad Poppenhusen and Ludwig Held, Brooklyn, New York; ante-dated April 1, 1857.

Claim.—"The process of rendering vulcanized india-rubber, gutta-percha, or allied gums, or their compounds, soluble and plastic, by the joint action of the solvents and dry ammonia gas."

109. For an *Improved Piano-Forte Bridge;* Thomas E. Power, Columbia, Mo.

Claim.—"The cutting away the end of the bridge upon which the treble strings rest, and the supporting of the same by bars in such manner as to permit a greater vibration in the surface of that part of the sound board which is under the treble strings in the piano-forte, to the end that the notes sounded by those strings may be more full and perfect."

110. For a *Trap for Animals;* Frederick Reuthe, Hartford, Connecticut.

Claim.—"The sliding and expanding spring-barbed fangs, in combination with one, two, or more exploding barrels."

111. For an *Improvement in Fountain Pens;* Charles A. Rosefield, Columbus, Georgia.

Claim.—"The detachable quill conductor fitting laterally in or to a rigid upper conductor or conductor holder, arranged to freely swivel on a centre pin or bearing at the bottom of or below the reservoir, for action with the pen and pen holder."

112. For an *Improvement in Binding Books;* Archibald H. Rowand, Allegheny, Pennsylvania.

Claim.—"The combination of the rollers in the groove or book carriage, as applied to books, to aid in moving them in their racks in a vertical position. Also, the application of the spring, used in compressing the extremities of the arch of the head band, and thereby causing said head band to maintain a circular or arch-like form, by means of which the leaves of a folio or book are kept from dropping or saging when the book is in a vertical position; this spring I use according to convenience or choice, either applied on the outside of the outer back or next to the head band, or inclosed between the outer and inner backs."

113. For an *Improvement in Bumper Railroad Car Brakes;* Louis Brauer, Sommerville, Tennessee.

Claim.—"The sliding bumper, in connexion with clamp and stop-piece. Also, the elastic hinge within the tapering sleeve."

114. For an *Improved Machine for Planing Chair Seats;* Edward Q. Smith, Cincinnati, Ohio.

Claim.—"The combination by means of the universally jointed shaft of the feed-wheel, with the eccentric, when the said wheel derives its motion from the chair seat."

115. For an *Improvement in Heating Soldering Tools by Gas;* J. Henry Stimpson, Boston, Massachusetts.

Claim.—"The perforated cylinder enclosing the soldering copper, in combination with the cylinder or chamber, which concentrates the heat. Also, detaching the soldering tool, and regulating the supply of gas by compressing the pipe."

116. For an *Improved Portable Field Fence;* Seth C. Tufts, Mainville, Ohio.

Claim.—"Supporting the panels vertically upon the coupling blocks. Also, providing the chairs with upright cleets."

117. For an *Improved Soap Substitute for Scouring Woolens;* Louis Wilman, Worcester, Massachusetts.

Claim.—"The fulling and felting liquid composition, composed of soda ash, salt, and bran."

118. For an *Improvement in Rock Drills;* John D. Hope, Niagara Falls, N. Y., Assignor to G. Arthur Gardner, City of New York.

Claim.—"The formation and shaping of the wings or ridges on the transverse corners of the drill."

119. For an *Improvement in Seed Planters;* Charles Ketchum, Assignor to Charles G. Judd, Penn Yan, New York.

Claim.—"The blades, in combination with the bolts. Also, the adjustable cylinder in combination with the band and sack."

120. For an *Improved Sub-marine Excavator;* William Kennish, Brooklyn, N. York, Assignor to Andrew B. Gray, San Diego, California.

Claim.—"1st, The combination and arrangement of the chambers with their pipe,

valves, weights, or of any equivalent thereof. 2d, The arrangement of the cylinders with their pipes and hose, or their equivalents, whereby the mud chamber and floating chamber are alternately filled with, or emptied of, air, as the means of collecting and floating off the excavated material."

121. For an *Improvement in Copying Presses;* Wm. Morris Smith, Assignor to self and Peter Hannay, Washington, D. C.

Claim.—"1st, The levers, in combination with the links. 2d, The method of adjusting the platen and bed plates, so as to take a book of greater or less thickness. 3d, The slotted upright on the bed plate, in combination with the arms of the platen for the purpose of preventing lateral motion."

122. For an *Improved Method of Preparing Canvass for Printing, Painting, &c.;* Elisha Lee, Baltimore, Maryland.

Claim.—"The composition of the above ingredients to produce an oil ground, possessing the before mentioned qualities, without sizing the canvass."

123. For an *Improvement in Gas Generators;* James A. Bruce, Assignor to the Maryland Portable Gas Company, Baltimore, Maryland.

Claim.—"The new and improved gas retort with smoke attachment, by which atmospheric air is admitted at bottom to clean, and purifying material by combustion."

MAY 19.

124. For an *Improvement in Cordage Machines;* James P. Arnold, Louisville, Ky.

Claim.—"The combination of a series of two or more pulleys, each pulley arranged to rotate on its own axis, and to revolve around a centre common to all, with a ring concentric to said circle of revolution, whose surface, adjacent to the pulleys, is elastic and forms a track for the pulleys to roll on."

125. For an *Improvement in Port-folios;* Robert Arthur, Philadelphia, Penna.

Claim.—"1st, A port-folio made with an elastic back or hinge, combined with an elastic fastening. 2d, Making the hinge and fastening adjustable."

126. For an *Improvement in Projectiles;* Christopher C. Brand, Norwich, Conn.

Claim.—"The improved fuse tube or plug, as constructed, with two plug chambers separated by a breech or partition. Also, the improvement of making said tube with an encircling chamber or recess."

127. For an *Improved Arrangement of Devices for Dressing Pieces of Lumber;* Harvey Brown, City of New York.

Claim.—"The movable frame, or its equivalent, as supporting the planer and the jointer, which, by means of the set screws, connect it with the frame, by which arrangement pieces for barrel heading or other purposes can be sawed, planed, and jointed simultaneously, of any desired thickness or width, within the compass of the machine."

128. For an *Improved Hand Truck;* Ze Butt, Lincolnton, North Carolina.

Claim.—"The manner of constructing, arranging, combining, and operating the dumping truck, or any other manner or method essentially the same."

129. For *Improved Devices for Dogging Lumber in Planing Machines;* David N. B. Coffin, Jr., Newton, and Henry D. Stover, Boston, Mass.

Claim.—"The bar, constructed and arranged in combination with the rack, or its equivalent. Also, the device for the rear end of the platen, so constructed and arranged that the dogging bars are clamped firmly to the platen, at same time that they adjust themselves to the form and position of the end of the lumber, by the operation of a single screw."

130. For an *Improved Machine for Gathering and Depositing Dipped Matches;* Thomas Cook, City of New York.

"The invention consists of a means for automatically discharging the matches from the 'dipping boards,' and depositing the same into the boxes, without said matches requiring any handling by the workman."

Claim.—"The method of feeding the 'dipping boards' in connexion with the operation of the discharging pins. Also, the receiving table, with its gathering and deliver-

ing blocks, in combination with the aforesaid means for conveying and discharging the matches from the 'dipping board.'"

131. For an *Improvement in Gas Regulators;* Robert Cornelius, Philadelphia, Penna.

Claim.—"The employment of the auxiliary spring box, communicating directly with the main chamber, in combination with the valve communicating with the middle chamber, for the purpose of preserving the uniform action of the regulator under considerable variation in the main pressure."

132. For an *Improvement in the method of Treating Straw Braid for Hats, &c.;* George Cornwall, 2d, Milford, Connecticut.

Claim.—"The method of simultaneously beveling, curving, stretching, and smoothing the braid."

133. For an *Improvement in Piano-forte Actions;* Spencer B. Driggs, City of N. Y.

Claim.—"Balancing or placing the centres of motion of the keys at, above, or near the top thereof, instead of at the bottom or centre."

134. For an *Improvement in Gunpowder;* Lammot Dupont, Wilmington, Del.

Claim.—"The manufacture of gunpowder by the use of nitrate of soda, and the glazing of the powder so made."

135. For an *Improved Blanket for Calico Printing Machines;* John Fallon, Lawrence, Massachusetts.

Claim.—"The combination of the short india-rubber blanket, with the multiple fold of 'greys' passing once through the machine."

136. For an *Improvement in the Shuttle Motion for Looms;* Levi Ferguson, Lowell, Massachusetts.

Claim.—"The combination of the rest carried by the rock shaft, the curved sliding guide rod, connected with the picker staff and the box, attached to the rock shaft, the latter serving not only to guide the sliding guide rod, but also to contain the spring by which the picker staff is thrown back after throwing the shuttle."

137. For an *Improvement in Violins;* Bradley Fitts, Charlton, Massachusetts.

Claim.—"The application of bells within the interior of, or behind the sounding board of a violin, or other stringed musical instrument."

138. For an *Improvement in Machines for Cleaning Grain;* J. R. Gates, Eckmansville, Ohio.

Claim.—"The box, divided into two compartments by the partition, the fan box, and scouring box, provided with the stones and rotating beaters, when the above parts are arranged relatively with each other: it being understood that I do not claim separately either of the parts, but all the said parts when arranged and combined so as to operate conjointly."

139. For an *Improvement in Machines for Re-dressing Mill-Stones;* W. Y. Gill, Henderson, Kentucky.

Claim.—"The combination of two or more picks, with the guiding and operating screw-shaft and lifting cams."

140. For an *Improvement in Pumps;* Silas Hewit, Seneca Falls, New York.

Claim.—"The arrangement of the tubes, piston head, and valves."

141. For an *Improvement in Grain and Grass Harvesters;* John H. Keyser and Edward M. Mobley, Hagerstown, Maryland.

Claim.—"Operating the cutter bar from the driving-wheel, by means of a fork and arm, in combination with rocker and slotted arm, when said parts are constructed and arranged to operate in relation to each other."

142. For an *Improved Machine for Making Wash-boards;* Edward and Britain Holmes, Buffalo, New York.

Claim.—"1st, Increasing both stiles of the wash-board at the same time, and also entering the zinc into the incision in both stiles at the same time. 2d, Raising and lowering the end of the sliding arm at its connexion with the vibrating lever, for the purpose of controlling the number of blows to be given by the drivers, and the forces

thereof. 3d, The combination of the expanding iron frames, with the wedge and cutters. 4th, The combination and arrangement of the series of levers with the pin and spiral spring, and hook, or their equivalents. 5th, The combination of the spiral spring (or its equivalent,) with the lever and rod, for the purpose of continuing the movement of the lever after the incision is made in the stiles, and the cutter withdrawn, so that the stiles will be carried to the zinc, and the zinc entered in the incision made by the cutters. 6th, The application of the eccentric in connexion with the lever and its arrangements (or its equivalent,) for the purpose of applying power to make the incision in both stiles of the wash-board at the same time, and also to facilitate the entrance of zinc into both stiles at the same time."

143. For an *Improved Process for Removing Photographs from Glass to Paper;* Edward Howell, Ashtabula, Ohio.

Claim.—"The mode of transferring a positive impression from glass plate to paper, or other desired substances, by means of a coating of bees-wax upon the glass plate."

144. For an *Improved Mode of Fastening Sheet Metal on Roofs, &c.;* Asa Johnson, Cairo, Assignor to self Wm. Higbie, and Henry Link, Little Falls, New York.

Claim.—"The self-adjusting fastener for the purpose of attaching metallic covering to buildings, and accommodating itself to the contraction and expansion of the metal, and for the fastening metals in any and all other places where the contraction and expansion demand accommodation, or any mechanical device equivalent thereto."

145. For an *Improved Joiners' Plane;* James Lashbrooks, Owensborough, Ky.

Claim.—"The curved plane iron and cap, in combination with the curved back-rest and slotted plate."

146. For an *Improvement in Friction Rollers for Journals of Shafts, Axles, &c.;* William H. Main, Litchfield, Ohio.

Claim.—"Arranging the two series of friction wheels at any suitable angle with the line of the journal, so that when they, the said wheels, are placed in a suitable box or wheel, the journal of said shaft may be supported and braced in all directions; the friction wheels having their journals supported by a series of embracing rings, which thus form their rolling bearings."

147. For an *Improvement in Machinery for Dressing Sewing Thread, Warps, or Yarns;* J. D. Minder, Killingby, Connecticut.

Claim.—"The employment for dressing sewing thread and yarns of a series of straight brushes, arranged in pairs, and having a crank motion towards and from each other, so that the several pairs engage and move together along the thread or yarn."

148. For an *Improved Approach Opening Gate;* George W. McGill, Buffalo, N. Y.

Claim.—"The combination of levers, rack, and cog-wheel, for operating a gate."

149. For an *Improved Apparatus for Reducing Zinc Ores;* Alfred Mounier, Camden, New Jersey.

Claim.—"The combination of the gas generator and the reducing furnace."

150. For an *Improvement in Running Gear of Carriages;* Richard Murdoch, Baltimore, Maryland.

Claim.—"Giving to the brace levers a forward and outward projection from the short axles."

151. For an *Improved Valvular Arrangement in Apparatus for Raising Water;* Andrew Nicol, Carbondale, Pennsylvania.

Claim.—"The rods provided with the valves, and operated in combination with the chambers or vessels, suction pipe, and branch pipes, and the tubes provided with the valves."

152. For an *Improved Basin Faucet;* Erastus Stebbins, Chickopee, Mass.

Claim.—"Combining and arranging the tubular bearer with the spindle, the valve case, and adjusting screw. Also, the combination and arrangement of elevating and depressing cams, (or their equivalents,) and the plane or bearing surfaces, the same being applied to the spindle and valve."

153. For an *Improved Rotary Planing Cutter;* Henry D. Stover, Boston, Mass.

Claim.—"My method, or its mechanical equivalent, for securing double or single cutting irons to cutter heads, to hold them secure when in use."

154. For an *Improvement in Lifting Jack;* William Thomas, Hingham, Mass.

Claim.—"The retaining pawl, provided with the weighted arm, attached to the standard, arranged relatively with the pawl and catch."

155. For an *Improved Shirt Stud or Button;* Wm. Voght and John J. Klink, Louisville, Kentucky.

Claim.—"Shirt studs or buttons, sleeve buttons, breast pins, or any other article of jewelry or ornament, made with the bar and the hook."

156. For an *Improved Device for Allowing Play to the Arbors of Circular Saws;* Harvey R. Wolfe, Louisville, Kentucky.

Claim.—"The bar or lever having an elastic and a stiff or rigid portion, and pivoted to the bar; the elastic end of the bar or lever being connected with the saw arbor or shaft, and the stiff or rigid part with the sliding guide through the medium of the rod and lever, whereby the bar or lever performs the double function of spring and lever; the saw and guide being both moved laterally when necessary, by actuating the bar or lever, and when the outer end of the bar or lever is secured or made permanent, the inner end or part serving as a spring to allow the saw an independent lateral play or movement."

157. For an *Improved Centrifugal Battery;* Albert Potts, Philadelphia, Penna.

Claim.—"The combination."

158. For an *Improvement in Stencil Plate Printing;* Samuel T. Sanford, Fall River, Massachusetts.

Claim.—"Having the stencil plate made in the form of an endless belt."

159. For an *Improved Machine for Compressing the Ends of Blind Slats;* Luther T. Smart, Manchester, New Hampshire.

Claim.—"The machine, or its equivalent, for crimping shades to blinds, consisting essentially of the sliding dies, in combination with the cams, the rods, the slide, and the pressure studs, with the rack connected together."

160. For an *Improved Arrangement of Safety Valves within Steam Boilers;* George P. Clarke, Assignor to self and Wm. M. Littell, Newark, New Jersey.

Claim.—"The arrangement of the inverted valve in globe, pressed to its seat by the spring from below, the clevis and the escape pipe extending through the boiler, all constructed and arranged within the boiler."

161. For an *Improvement on Apparatus for Indicating the Speed of Vessels and Depth of Water;* David Hinman and F. B. Fournier, Berea, Ohio, Assignor to selves and R. I. Parker, Ogdensburg, New York.

Claim.—"The arrangement of the movable wing, with its joint, the rod and rack combined, with the dial or indicator."

162. For an *Improved Method of Printing in Colors;* William Croome, Brooklyn, New York.

Claim.—"The movable tablets for the separate colors, in combination with the guided roller, or equivalent surface, for taking up the inks. Also, in combination with the printing surface, and with the inking surface, the corresponding guides for ensuring the uniform action of the inking surface upon the printing surface."

163. For an *Improvement in Mowing Machines;* Thomas Harding, Assignor to Warder, Brokaw & Child, Springfield, Ohio.

Claim.—"The combination with a mowing machine of the peculiarly constructed truck, when both are arranged to operate in relation to each other."

164. For a *Combined Lantern and Oil Can;* Wm. G. Russell, Assignor to self and Wm. Sewell, City of New York.

Claim.—"The attachment of a lamp or light to an oil can or feeder, for illuminating the place to be oiled."

165. For an *Improvement in Machines for Folding Paper;* Edward N. Smith, Springfield, Assignor to Steuben S. Bacon, Boston, Massachusetts.

Claim.—"1st, The employment of points or register pins, or their equivalents, for the purpose of correctly presenting sheets of paper to a folding apparatus. 2d, The manner of adjusting the register pins, and their peculiar movement. 3d, Combining with the knives or straight edges, or their equivalents, the points projecting beyond the edge thereof, for steadying the sheet while being folded. 4th, Reducing the speed of the succeeding sets of rollers from first to last, so as to proportion the distance traversed by the sheet at each succeeding fold to the reduction of its size, so that the time the sheets are moving from point to point shall be equal or nearly so. 5th, The adjustable stop for determining the proper position of the sheet to receive its second and succeeding folds. 6th, The combination of the fly with the folding apparatus for laying off the folded sheets."

166. For an *Improvement in Looms;* Nathaniel B. Carney, Assignor to John B. Livingston, Charles H. Haswell, and Russell C. Root, Trustees, City of New York.

Claim.—"1st, The weaving of fabrics within and upon a circular frame or looms, arranged about a common centre, producing the fabric at the central part, the shuttles being carried in a circle round the frame or loom in a continuous movement, the warps, shuttles, and filling being placed at the top of the loom, and the machinery for operating acting underneath, the weaving being effected by machinery. 2d, The combination and arrangement of the machinery acted upon and driven by the spur-wheel, and its eccentric grooves and their connexions, by which the sliding frames holding the warp wires or heddles are caused to reciprocate in opposite directions in equal times and regular succession, and the shuttles are made to rotate about the circumference of the loom, in a plane perpendicular to the planes of motion of the sliding frames, and in equal times, so as to pass between the upper and lower sets of warp threads when apart, thus producing a fabric at the central point. 3d, The combination of the roller covers and barrels. 4th, The combination and arrangement or mechanism of the flat wheels or disks, with their grooves, with eccentrics, the cams and connecting rods, and slides, the roller covers, the levers, bolts, and slides, the levers carrying a motion from the rollers and covers to the warp wires, so as to hold them fast or set them free to move with the frames, the whole operating in conformity with, and its connexions thereby regulating the pattern, shape, or figure, of the fabric to be woven. 5th, The giving to the shuttle the same continuous line of motion, without any divergence, thus avoiding the danger of injuring the operator or the fabric from an accidental false direction of the shuttle. 6th, The form and construction of the shuttle, having its teeth on the under side or outside of its arc, and also, the shuttle constructed so as to adapt itself to the increasing growth of the fabric, and pressing up the filling."

167. For an *Improved Spring Hinge;* Dr. Joseph S. Smith, City of New York; ante dated May 12, 1857.

Claim.—"The use of the centre pin, and capped springs, constructed, secured, and operated within the tubular knuckle, having a double lapped joint."

168. For an *Improved Electro-magnetic Fire Alarm Telegraph for Cities;* Wm. F. Channing, Boston, and Moses G. Farmer, Salem, Massachusetts, Assignors to Wm. F. Channing, aforesaid.

Claim.—"1st, The signal system, consisting of a series of signal stations, scattered at short intervals through a whole city or town, or any part thereof, and telegraphically connected with a common centre or point, or with each other, by one or more signal circuits, by which means a constant communication may be established and maintained between all parts of a city or town, however extended, and with the centre or centres at which the signal circuit or circuits converge or meet, so that the moment a fire occurs, its existence and locality may at once be known at the centre of the system, and efforts for subduing it properly directed. 2d, The alarm system, consisting of a series of alarm stations suitably distributed throughout a whole city or town, or any part thereof, and telegraphically connected with a central station by one or more alarm circuits, by which means a public alarm of the existence and locality of a fire may be given at different points. 3d, In combination with the alarm system for striking the number of the district upon the alarm bells, the signal system for communicating the number of the station at which the fire occurs to all the signal stations, as well as for communicating an alarm to the central station."

169. For an *Improved Shingle Machine;* C. M. Young, Sinclearville, New York.

Claim.—"Operating or giving the necessary feed motion to the block and bolt, by means of the laterally reciprocating bar actuated by the eccentric grooves in the wheels, the bar vibrating the block through the medium of the bar, the block being provided with pawls which catch into the racks in the frame. Also, the saws placed in the frame or sash, which is secured at the back of the gate, and operated from the bar. Also, the bar when arranged so as to be driven or operated from the gate, whereby the several parts of the machine are all made to work automatically."

MAY 26.

170. For an *Improvement in Spinal Corsets;* Alanson Abbé, Boston, Mass.

Claim.—"My improved manufacture of corset for the cure of spinal deflexions, the same being made with counteracting springs, constructed and arranged laterally and longitudinally in the back portion thereof."

171. For an *Improvement in Mowing and Reaping Machines;* Amory Amsden, Rochester, New York.

Claim.—"The combination of a continuous helix with the cutters, when said helix forces the grass or grain against the cutters in a direction transverse to the direction in which the helix revolves."

172. For an *Improved Construction of Vehicles;* Charles Atkinson, Danville, and Gilbert S. Manning, Springfield, Illinois.

Claim.—"The construction of the vehicle, viz: the two pairs of springs attached to the ends of the front and back axles, the springs of the back axle being attached directly to the bed, and the springs of the front axle attached to the bed by the ball and socket joint, the inner ends of said springs being attached to a plate provided with a friction roller, which rests or bears upon a segment guide. We only claim the several parts when considered as a whole."

173. For an *Improvement in Revolving Fire Arms;* Fordyce Beals, New Haven, Connecticut.

Claim.—"Making the spring catch by which the cylinder is locked in position for the discharge to conform to the periphery of the cylinder, and project in front of the recoil shield on one side of the cylinder, for the purpose of serving as a resting place or seat to hold the cylinder in place for the insertion of its central arbor."

174. For an *Improvement in Griddles;* Wm. Bennett, City of New York.

Claim.—"The griddle and its ventilating cover, the former being constructed with a flaring flanch, opening *b*, sliding register *c*, and openings *d*, and the latter with an enlarged opening and flue."

175. For an *Improved Hand Seed Planter;* Silas P. Briggs, Saratoga Springs, New York.

Claim.—"The set or fastener, in combination with the plunger."

176. For an *Improvement in Grain Scourers and Separators;* Samuel Canby, Ellicott's Mills, Maryland.

Claim.—"The series of scouring disks and self-adjusting conical rubbers on the same shaft, and alternating with the disks, in combination with the hoppers, performing the double function of rubbing and concentrating the grain, the perforated casing surrounding all of the disks except the lower, and the tight outer casing arranged and operating to effect a progressive cleaning and final separation of the grain."

177. For an *Improved Machine for Cutting and Bending Sheet Metal;* Elias F. Coates, Mystic Bridge, Connecticut.

Claim.—"The cutting and bending of sheets of tin or other metal for roofs, by one operation, and through a combination of devices."

178. For an *Improvement in Means for Reefing Top-sails;* James E. Cole, City of New York.

Claim.—"The supplementary shaft, in combination with the roller spar."

179. For an *Improvement in Sewing Machines;* Solomon B. Ellithorp, City of New York.

Claim.—"The attachment of the primary moving power to give motion to the needle in direct communication with the needle stock, and in vertical line with the needle."

180. For an *Improved Tongue and Castor Plate for Harvesting Machines;* Ralph Emerson, Jr., Rockford, Illinois.

Claim.—"The tongue and castor plate."

181. For an *Improvement in Curtain Rollers;* Chandler Fisher, Milton, Mass.

Claim.—"The employment of a spring, in combination with the pivot of a curtain roll, for the purpose of producing friction between the roll and the window frame, and thereby holding the curtain in any position in which it may be placed."

182. For an *Improvement in Wagon Couplings;* W. D. Guseman, Morgantown, Va.

Claim.—"Coupling the hind and fore wheels of a wagon, by means of an adjustable reach, and a correspondingly adjustable piece on the front bounds, to which the rear bounds are pivoted."

183. For an *Improved Bomb Lance;* Julius Grudchos and Selmar Eggers, New Bedford, Massachusetts.

Claim.—"The arranging the tube; the arranging the trigger, the trigger spring, the sear spring, the main spring, the hammer, the tube. Also, applying the grooved ball for the purpose of giving the lance a rotary motion to prevent it striking sidewise."

184. For an *Improvement in Cooking Stoves;* Joseph Hackett, Louisville, Ky.

Claim.—"The employment in combination with the dampers of the oven and doors, of a rising and falling catch bar, which has a turning knob, which is so arranged that in turning it shall rise over an inclined plane or stationary stop on the door."

185. For an *Improvement in Registering Apparatus for Printing Presses;* Gordon McKay, Boston, Massachusetts.

Claim.—"The use of brushes, or equivalents, when automatically operated and combined with register points."

186. For an *Improved Sugar Boiling Apparatus;* Adolph Hammer, Reading, Pa.

Claim.—"The peculiar arrangement of pipes, whereby the steam is caused so to travel as to force one continuous and unbroken stream through the pipes, and to form a proper compensation or equalization of temperature throughout the whole surface of the coil."

187. For an *Improvement in Ink-Stands;* Bennett J. Heywood, London, England; patented in England, January 16, 1856.

Claim.—"The means of forcing ink into the fountain of ink-stands, by the combined action of the lower valve and the aperture in the top plate or disk, which acts alternately as a closed and open valve by the application and removal of the finger."

188. For an *Improvement in Ore Crushing Machines;* Samuel F. Hodge, Detroit, Michigan.

Claim.—"The alternate lifting and dropping of a stamper hammer, or any weight, by means of a combination of a vertical rod with two clamping rollers, the periphery of one of which is not a complete circle."

189. For an *Improvement in Looms;* Wm. H. Howard, Philadelphia, Penna.

Claim.—"The holding of the threads of weft and warp in a web of cloth, extended by combs applied to the selvedges and warp threads thereof, or by any other equivalent mechanism."

190. For an *Improvement in Apparatus for Discharging Horse and Shafts from a Carriage;* Gilbert Hubbard, Sandersville, Massachusetts.

"The object of my invention is to enable a person who may be in a carriage with which a horse is running away, to free the body and wheels, or running parts, from the shafts and horse; also, to provide the shafts with a means by which when they are detached from their carriage, their rear ends may be maintained at such a height above the ground as to prevent their cross-bar from falling on the horses' hind legs, and doing injury thereto."

Claim.—"The shaft rest or legs, in combination with the shafts and bolting apparatus, and operated thereby for the purpose of supporting the shafts after their detachment from the carriage. Also, the combination and arrangement of mechanism for attaching the shafts to, and detaching them from the axle connexions, such combination consisting of the bolts, the sectors, the turning lever frame, and the rotary foot cam, connected and made to operate together. Also, the combination of the lever and hold fast cam, with the turning pawl, and the slider connected with the latter."

191. For an *Improvement in Washing Machines;* Abraham Huffer, Hagerstown, Md.

Claim.—"The arrangement of slotted levers, and upright springs, connected and operated upon by the pulley taps, pulley cord, shaft, and crank, for the purpose of facilitating the parallel adjustment."

192. For an *Improved Shingle Machine;* Wm. A. Jarrett, Patonsville, Tennessee.

Claim.—"Elevating and depressing the knife, and retaining the same in the required position, by means of the bar on the bottom of the carriage operating upon the cams of studs. Also, the automatic apron, whereby the shavings are all taken from the shingles and knife, and thrown from the machine, the apron returning successively to a horizontal position to receive the shavings.'

193. For an *Improvement in Reels for Yarn or Thread;* Christian Knauer, Pittsburgh, Pennsylvania.

Claim.—"The combination of the plates provided with the ratchet and pawl, the curved arms, and swivel guide."

194. For an *Improvement in Corn Planters;* Robert Kuschke and Peter Merkel, St. Louis, Missouri.

"The invention consists in planting corn by means of movable boxes, which by passing on a frame to and fro, drop the necessary number of corns at every four feet through a hole in the bottom, and through a corresponding hollow planter into the ground."

Claim.—"The reciprocating seed boxes, arranged and operated."

195. For an *Improvement in Sizing Compositions for Yarns, Paper, &c.;* John Leigh, Manchester, England.

Claim.—"The sizing and dressing of yarns, woven goods, and paper, by means of the alkaline silicates."

196. For an *Improvement in Fire Arms;* Edward Lindner, City of New York.

Claim.—"The construction, arrangement, and operation of the rack, when composed of a series of cones superposed to each other, the bases of said cones bearing upon studs that propel the cartridges in one or more charge barrels ranged round said rack. Also, revolving the breech piece by the mechanism, when arranged to act upon the interior surface. Also, the plate placed in front of the breech chamber, for the purpose of retaining the cartridges in said chambers which do not face the barrel. Also, the knee-piece, in combination with the hammer and stop-bolt, the said parts being so arranged in relation to each other, that by the act of cocking the gun, the stop-bolt shall be withdrawn from the recesses of the breech, thus leaving it free to revolve."

197. For an *Improved Hydro-dynamic Machine for Testing Strength of Materials,* Francis C. Lowthrop, Trenton, New Jersey.

Claim.—"The combining of gearing and other suitable mechanism for applying strains or forces to the object to be tested, with a piston or plunger, operating against a body of water within a cylinder or barrel, in such a manner that on applying the said force or strain, such a pressure shall be transmitted to the fluid and to any suitable indicator communicating with the same, that the amount of strain or force on the object may be readily calculated."

198. For an *Improved Wind-Wheel;* James Mitchell, Woodsfield, Ohio.

Claim.—"1st, Placing the arms of the fans obliquely, so as to have a proper degree of inclination with the shaft. 2d, Attaching the arms to the levers, and connecting said levers to the sliding collars, for the purpose of adjusting the arms more or less obliquely with the shaft."

199. For an *Improved Ore Washer;* Pierre P. Martin, Paris, France; patented in France, May 13, 1856.

Claim.—"The general arrangement of the apparatus."

200. For an *Improved Repeating Fire Arm;* Wm. W. Marston, City of New York.

Claim.—"The combination of the exploder and cylinder, actuated by the dog, or its equivalent, to explode successively the barrels arranged vertically over each other."

201. For an *Improvement in Making Paper Pulp;* Marie A. C. Mellier, Paris, France; patented in France, August 7, 1854; patented in England, October 26, 1855.

Claim.—"The use of a solution of caustic soda (*n a o*) in a compartment of a rotary vessel separate from that which contains the steam heat. Also, the process for bleaching straw, consisting in boiling it in a solution of pure caustic soda (*n a a*) from 2° to 3° Beaumé, at a temperature not less than 310° Fahrenheit after it has been soaked and cleaned, and before submitting it to the action of a solution of chloride of lime from 1 to 1½ degrees."

202. For an *Improvement in the Manufacture of Iron and Steel;* Robert Mushet, Coleford, England; patented in England, Sept. 22, 1856.

Claim.—"The addition of a triple compound or material of or containing iron carbon and manganese to cast iron, which has been purified and decarbonized by the action of air whilst in a molten or fluid state, or in any convenient manner so as to become mixed and combined in the process of manufacture, in order by the union of these substances to obtain malleable iron and steel."

203. For an *Improvement in Brick Machines;* Stephen Parks, San Francisco, Cal.

Claim.—"Feeding the moulds to or underneath the moulding or press-box, and also discharging them therefrom by means of the reciprocating and swinging cross-head, operated by the rods, connected with the slides, and the shafts, when used in combination with the pivoted inclined planes and projecting arms."

204. For an *Improvement in Cotton Cultivators;* Alexander A. Roberts and Baldwin Davis, La Grange, Georgia.

Claim.—"In combination with the frame and brake, the movable frame armed with hoes and a harrow, the teeth of said harrow being so arranged as to cultivate between the bunches of cotton, and at the same time clear the standing cotton plants from clods, &c."

205. For an *Improvement in Fertilizing Compounds;* Louis S. Robbins, Brooklyn, New York.

Claim.—"The new composition of matter obtained by the intimate mixture of green sand and super-phosphate of lime in a finely pulverized form."

206. For an *Improvement in Machines for Making Stove Pipe;* M. C. Root, Toledo, Ohio.

Claim.—"The arrangement and combination together of the edging, grooving, forming, swaging, and expanding, and contracting, rollers. Also, giving a spiral form to the groove of roller."

207. For *Improved Machinery for Compressing Gaseous Bodies;* Wm. A. Boyce, Newburgh, New York.

Claim.—"The apparatus for compressing and packing gaseous media."

208. For an *Improved Bit for Cutting Out Cylindrical Plugs of Wood;* Cyrus W. Saladee, Columbus, Ohio.

Claim.—"The projecting lips or cutters, for the purpose of cutting out round plugs of wood."

209. For an *Improvement in Apparatus for Examining Vessels' Keels;* James E. Simpson, East Boston, Massachusetts.

Claim.—"The apparatus for examining keels of vessels, consisting essentially of the levers and rods."

210. For an *Improvement in Corn Planters;* F. J. Smith, Four Corners, Ohio.

Claim.—"The combination of the rods and cut-off plates, with the springs and the inclined recesses in the tongue."

211. For an *Improved Machine for Cutting Grooves and Slots;* Robert F. Underhill, Indianapolis, Indiana.

Claim.—"1st, Forming cutting edges on the outer ends of the cogs of cog-wheels,

2d, The combination of the cutter as constructed, the cogged wheels, the shaft, and the slotted arbor, with the adjustable wedge and table, or any equivalent device."

212. For an *Improved Tanning Apparatus;* Otis B. Wattles, Haddington, New York.

Claim.—"The hides laced in the frame entirely around its border, and sustained vertically in the vat."

213. For an *Improvement in Sewing Machines;* Thomas S. Wells, Utica, New York.

"This invention relates to that description of sewing machines, in which the sewing is effected by a needle with a point at each end, passing entirely through the cloth or other material to be sewed, from opposite sides, alternately. It consists in certain means of taking up the slack of the thread, which prevents it catching or tangling, and admits of a longer needle full of thread being used than is admitted in machines of the same kind as heretofore constructed. It also consists in an improvement in the needle, by which facility is afforded for inserting the thread, and at the same time provision is made for securing the end of the thread therein."

Claim.—"1st, The employment of a wheel to carry the finger, and take up the slack of the thread on its periphery, as it is drawn through the cloth in tightening the stitch. 2d, Enclosing the wheel within a case to prevent the thread slipping off the wheel, and to guide the slack while it is being drawn through the cloth in the production of the successive stitches."

214. For an *Improved Thermo-Pneumatic Safety Valve;* S. H. Whitaker and Ezra Cope, Cincinnati, Ohio.

Claim.—"The self-acting air valve, consisting of a chamber whose top is composed of a flexible diaphragm, or its equivalent, filled with bees-wax, or other fusible substance, that solidifies at atmospheric temperatures, but is expansible by heat, and that will act upon the diaphragm to open and close the passage through the combined agencies of expansion and contraction by heat, gravitation, and cohesive attraction."

215. For an *Improvement in Seed Planters;* Jesse Whitehead, Manchester, Virginia.

Claim.—"The combination of the trough with its spout and receptacle, when used in connexion with a seeding apparatus, for the purpose of dividing and retaining the excess of seed from that which is to be planted."

216. For an *Improved Compound Gauge;* Albert Williams, Philadelphia, Penna.

Claim.—"The combination of the four several gauges in one tool, and all operating on the same end of the stem, the mortise working with an anti-friction screw, the head of which is at the bottom or end of the stem."

217. For an *Improvement in Looms;* Franklin Painter, Assignor to The Nashuawannock Manufacturing Co., East Hampton, Massachusetts.

Claim.—"1st, A divided or sectional reed. 2d, In combination with such, a divided or sectional reed, a take up motion or apparatus which is thrown out of action at certain proper periods. 3d, A pattern barrel, or its equivalent, in combination with vibrating levers. 4th, An apparatus, viz: a pattern barrel, or its equivalent, in combination with a primary pattern barrel, or its equivalent, arranged in such manner, that the former shall at proper times present the selection of heddles or leaves of heddles by the latter. 5th, A latch. 6th, A divided reel, in combination with proper mechanism for forming a shed on one side only of a slit or button at the same time. And, lastly, a primary barrel for selecting heddles or leaves thereof, in combination with a secondary pattern barrel for preventing their selection, and vibrating levers acted upon by both barrels, or the equivalents of these parts in combination, each acting in combination with the others."

218. For an *Improvement in Printing Presses;* S. D. Learned, Boston, Mass., Assignor to A. C. Learned, City of New York.

Claim.—"The reciprocating frame provided with the inking and presser rollers, in combination with the ink and form beds, and tympan, provided with the rods and frisket, the above parts being arranged to operate conjointly."

219. For an *Improvement in Burglars' Alarms;* David Coon, Assignor to self and B. F. Chesborough, Ithaca, New York.

Claim.—"1st, So attaching the barrel of the pistol to its stock or plate, at or near

the muzzle, as to make a hinge joint at or near that point. 2d, The combination of spring plate, tumbler, and barrel, by which the barrel becomes the hammer, constructed so that when the pistol is properly fastend to the casing of the door, the barrel being cocked, shall be at such an angle, or in such a position, that the door on opening must necessarily press upon it, and thereby discharge the pistol, the contents passing outwards."

220. For an *Improved Projectile for Killing Whales;* Rufus Sibley, Assignor to Christopher C. Brand, Norwich, Connecticut.

Claim.—"An improved projectile (to be fired from a gun,) constructed with sheet metal wings, having journals, or turning on wires or journals, arranged so that the said wings may be turned down transversely or laterally on the body of the projectile, or in a recess or space made therein to receive them, each wing being arranged either parallel or inclined to the axis of the projectile."

221. For an *Improvement in Machines for Cutting India-Rubber, Gutta-Percha, and other Boot and Shoe Soles;* Stephen Thurston, Assignor to self, Marcus L. Ward, and Huntington & Co., Newark, New Jersey.

Claim.—"The combination and arrangement of the cutter cylinder and carrying cylinder, the cylinder being moved forward by the action of the cutters upon it, and moved backward by the eccentric on the cutting cylinder."

222. For an *Improvement in Tips for Sugar Moulds;* John Turl, City of New York, Assignor to Samuel Turl, Brooklyn, New York.

Claim.—"The construction of the tip with a recess to receive the body of the mould, and with a conical mouth opening in a contrary direction to the regular conical form of the interior of the mould."

223. For an *Improvement in Securing Nuts on Axles;* Thomas W. Williams, Assignor to self and Henry T. Hoyt, Philadelphia, Pennsylvania.

Claim.—"Securing nuts upon axles by means of the lever-key, and the mortises or recesses, the same being constructed and arranged so as to operate together."

224. For an *Improvement in Drop Presses;* Milo Peck, New Haven, Conn.

Claim.—"The combination of the male and female wheels with the sweep shaft, the ratchet wheel, the dog, and the guard ring, or their equivalents, so that the fall of the drop can be regulated and controlled. Also, the movable guard ring, in combination with the sweep shaft, the ratchet wheel, and the dog, or their equivalents, by means of which the time the drop shall remain upon the anvil can be regulated and controlled."

Re-Issues.

1. For an *Improvement in Turn Tables;* Jacob C. Robie, Binghampton, New York; patented August 15, 1854; re-issued May 5, 1857.

Claim.—"Balancing the platform of the turn table upon a transverse shaft, or other suitable bearing or bearings, resting upon, or connected with, the carriage which supports said platform, in such manner that the table, when in a horizontal position or thereabouts, is elevated above its under supports or end bearings, to admit of its free swing, and so that the table may be depressed at either end to bring the ends of its rails on either side of the carriage into line or level with the rails of the track."

2. For an *Improvement in Looms for Weaving Brussels Carpets, &c.;* Erastus B. Bigelow, Boston, Mass.; patented March 10, 1849; re-issued Oct. 9, 1849; re-re-issued May 5, 1857.

Claim.—"1st, In combination with the pile wire or wires for weaving pile fabrics, a grooved receptacle or trough for holding said pile wire or wires in position whilst being pushed into the shed of the warp. 2d, Pushing said pile wire or wires into the shed of the warps by a driver or pusher. 3d, Guiding and suppporting the pile wires as they are inserted into the shed of the warps by a guide or guides through, over, or on which said wires slide."

3. For an *Improvement in Machinery for Grinding and Polishing Metallic Surfaces, particularly Saw Plates;* Richard M. Hoe, City of New York; patented May 30, 1842; extended seven years from May 30, 1856; re-issued May 5, 1857.

Claim.—"In combination with the rotary and traversing motion of a cylindrical lap or grinding, or polishing surface, the reciprocating motion of the carriage which carries

the plate to be reduced or polished at right angles to the traversing motion of the rotating lap or grinding, or polishing surface, or as the equivalent thereof, a rotary motion. Also, constructing the said grinding, or otherwise reducing or polishing surface of a series of plates of any suitable substance, with spaces between the several plates."

4. For an *Improvement in Hanging Shafts in Mills;* Joseph Bancroft, Executor of Edward Bancroft, dec'd., Philadelphia, Pennsylvania; patented October 9, 1849; re-issued May 12, 1857.

Claim.—"In constructing the boxes for hanging shafting in mills, with circular cavities on the outer surface and on opposite sides, each cavity surrounding a bulb or projection in the form of a segment of a sphere, and having the required thickness of metal outside of such cavities for strength, when such tubes are combined with holding sockets which embrace said bulbs and which are so placed within the said concavities as to allow the boxes thus held to play within the sockets in manner of a universal joint. Also, combining the box which is provided with segments of a sphere on its outer surface, with the hanger pedestal or pillored block, by means of adjustable sockets."

5. For an *Improved Machine for Drying and Pressing Paper;* John North, Middletown, Connecticut; patented April 14, 1857; re-issued May 19, 1857.

Claim.—"1st, The encasing of the cylinders in part, and attaching of brushes inside of said cases, and the application of saw-dust, or other proper substance, for the purpose of cleaning the outer surface of the pressing cylinders. 2d, Combining two or more hollow steam or heated chests at proper distances apart, so as to admit of the sheets of paper to pass between said chests free and unobstructed, by means of endless belts, or their equivalents. 3d, Encasing the outer surface of the heated chests as combined by non-conducting substances, for the purpose of retaining the heat. 4th, In combination with the pressing cylinders, the drying apparatus, consisting of heated chests, between which the sheets of paper are passed on tapes, or their equivalents, without touching or dragging thereon."

6. For an *Improved Cowl or Draft Accelerator for Steamers;* Peter C. Guiou, Cincinnati, Ohio; patented November 4, 1856; re-issued May 25, 1857.

Claim.—"Their combination constructively."

DESIGNS.

1. For *Stoves;* Jacob Steffe, James Horton and John Currie, Assignors to F. H. Church, Philadelphia, Pennsylvania; dated May 5, 1857.
2. For *Cooking Stoves;* Jacob Beesley and Edward J. Delany, Assignors to Cresson, Stuart & Peterson, Philadelphia, Pennsylvania; dated May 19, 1857.
3. For *Stoves;* Russell Wheeler and Stephen A. Bailey, Utica, New York.
4. For *Churns, Egg Beaters, &c.;* John S. Gallagher, Jr., Washington, District of Columbia.
5. For *Picture Frames;* A. P. C. Boute, Cincinnati, Ohio; dated May 26, 1857.
6. For *Furnaces;* Willis S Bronson, Hartford, Connecticut; dated May 26, 1857.
7. For *Stoves;* Garretson Smith, Henry Brown, and Samuel H. Sailor, Assignors to J. G. Abbott and Archiles Lawrence, Philadelphia, Pennsylvania; dated May 26, 1857.

The claims on the above are for the several shapes, forms, and ornaments.

MECHANICS, PHYSICS, AND CHEMISTRY.

*Self-Indicating Balance Barometer.**

M. Secchi, of Rome, has recently invented a new construction of barometer, which possesses the advantages of not being liable to be broken, of giving the readings exact, which Aneroids and others do not, and of recording those readings by self-acting mechanism. M. Secchi says that all improvements hitherto have been limited to the employ-

* From the Lond. Civ. Eng. and Arch. Jour., Feb., 1857.

ment of large tubes to avoid the evils of capillary attraction, and to the obtaining of greater exactitude in the readings. All attempts to make the instrument graphic—that is to say, self-acting to record the different variations, and to make the indications more minute—have not yet been successful. The principles on which the new barometer is constructed will be understood by the following statement:—Suppose the cuvette of a barometer to be placed on a table and the glass tube so arranged as to admit of its being lifted by hand. The force that will be required to lift the tube will be equal to the weight of mercury in the tube, or in other words, to the amount of atmospheric pressure exercised on the mercury of the instrument. We shall therefore be able to really weigh the pressure of the atmosphere by attaching the barometer (the tube only) to one end of a balance, and weights to the other; for it is evident that at every change in atmospheric pressure a corresponding increase or decrease in weight will have to be made at the other end of the balance to maintain equilibrium. To ascertain the value of absolute pressure on a unity of surface, it will be necessary to take into consideration the weight of the tube, and also of the weight of that portion thereof which is immersed in the mercury contained in the cuvette, and especially the internal sectional area. The knowledge of the latter, so far from being an obstacle, is a positive advantage in construction; for, by increasing the sectional area, the force that actuates the instrument will also be increased, and will consequently permit of more exact and more minute readings. If the sectional area be 10 squares centimetres, and the pressure varies by centimetres in height, the weight to be placed at the other end of the balance will be that of 19 cubical centimetres of mercury, or 135 grammes; while, if the sectional area had been equal to one square centimetre only, the weight would have been but 13·5 grammes.

Starting from these observations, M. Secchi adopted the following construction for his barometer, which has been made and used in the observatory at Rome. The barometrical tube is attached to one end of a steelyard or balanced lever, which carries at the other end a counterbalance weight and a pointer, 15 millimetres, or $\frac{5}{8}$-inch diameter, which is reflected in a mirror. This mirror also reflects a graduated scale, so that the variation of $\frac{1}{10}$th of a line of the pointer is indicated by a movement of six lines on the reflected image. The writer enumerates the following advantages peculiar to his invention:—1. As the atmospheric pressure is weighed, and not indicated by the height of the column of mercury, the tube may be constructed of any non-fragile material, such as iron, which does not amalgamate with the mercury, provided the bore is of equal diameter throughout. 2. By increasing the sectional area of the tube, the additional weight will give sufficient motive power to a pencil attached to the other end of the lever to mark the variations of atmospheric pressure. 3. By the intervention of suitable gearing, the scale of observations may be augmented without inconvenience or danger to the exactness of the instrument. 4. The new construction is independent of the form of the miniscus, of the purity of the mercury, of its specific gravity, and of the temperature and difference of gravity peculiar to different latitudes, for all these qualities exercise influence upon the volume of mercury, and on the height of the column of mer-

cury in the tube, which has to be measured to obtain the weight of atmospheric pressure, whereas, with the new instrument, the weight is given at once. Another advantage of employing iron for barometrical tubes is, that there is no danger to fear from the adhesion of air or moisture, and that the mercury may be boiled without fear of bursting. Iron barometrical tubes will likewise permit of other fluids being employed, and probably advantageously, instead of mercury. The writer further states that he invariably found his new barometer indicate variations of atmospheric pressure before ordinary barometers did so, and that by avoiding loss from friction, most exact instruments may be produced. The perusal of the description of this ingenious invention has suggested its application to some practical purposes, which are submitted to the attention of engineering and scientific men.

---

*Fire-clay Moulds for Casting Pipes.**

The idea of using fire-clay surfaces, for casting iron pipes and other articles, was first practically developed by Messrs. Hoby and Kinniburgh, at the London Works, Renfrew, some four or five years ago.† Beginning with a solid coating of fire-clay over the whole length of the mould, Mr. Kinniburgh, who worked with great peseverance at his project, found himself gradually driven to the use of sectional portions of fire-clay bricks, and under this form we now find the system in successful operation. Our three illustrations exhibit the details of the whole process as applied for casting pipes. In fig. 1 we have represented the mode of moulding the sectional portions of fire-brick, with which the mould box is lined. All the pattern or original matrix which is necessary, is a short length of iron pipe, accurately turned externally. It is upon this that the fire-clay, with a slight admixture of sand, is moulded into the required sectional forms by means of an open brick mould or wooden frame, which is placed upon the pattern piece, so that the clay kneaded into it, is at once formed to the contour of the pipe, upon its inner or under surface. Our figure shows the dimensions of these sectional portions of fire-brick, which the inventor has found to be conveniently suitable for his purpose. At the earlier stages, of his work, he tried larger sizes, but experiment proved, that the smaller these sections are, consistent with regard to collateral requirements, the more accurate and satisfactory is the mould.

Fig. 1.

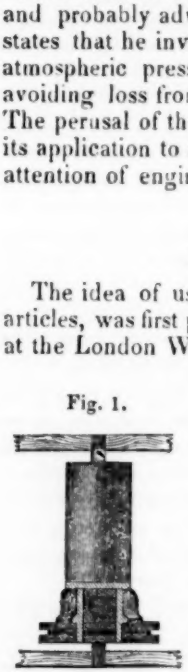


Fig. 2 is a sectional elevation of one of the moulds as lined with these bricks; the joints being filled up with a clay mortar, so as to bring the whole to an uniformly even surface, fit for shaping the metal to the required accuracy of form.

Fig. 3 is a section of the moulding pit where the casting takes place, showing the mould box open, with a finished core standing erect in the centre. The two halves of the mould box are hinged upon a bottom

* From the Lond. Prac. Mech. Journal, April, 1857.

† See page 263, Vol. vi., *Practical Mechanic's Journal.*

central stud-pin, over which part the core is set on end, when the two halves of the mould box are brought together, and the mould is ready for casting. Each half of the mould box has jointed to it a toothed rack, passed through a suitable guide on a pedestal, carrying the bearings for a winch spindle, on which is a spur-pinion, gearing with the rack. In this way, a few turns of the winch in either direction opens or closes the mould box. When the metal begins to set in the mould, the core bar, which is of the collapsable kind—also an invention of Mr. Kinniburgh—is slacked off or reduced in diameter, by merely turning the central actuating spindle. The two halves are then opened by their respective rack and pinion actions, and the newly cast pipe is left ready for removal. When the mould has somewhat cooled down, any flaws in its surface are easily repaired with a little clay composition, when the whole surface is blackwashed, so as to be at once ready for another casting.

There are just now at work in the London Works, Renfrew, three moulds of this kind, producing 18-inch pipes for the Blackburn Water Works. The pipes so made are very good specimens of work; the only evident fault about them, being a slight undulation of surface, arising apparently from some expansive distortion of the fire-clay surface. The two usual longitudinal fins are the only ones visible upon the surface of the pipes, which is clean and smooth, and the slight distortion to which we have referred, seems to affect nothing but the eye of the critical examiner, for the work can be in no way injured by it.

Fig. 2.

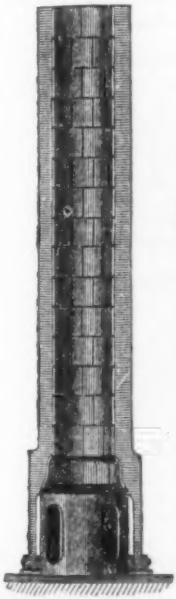
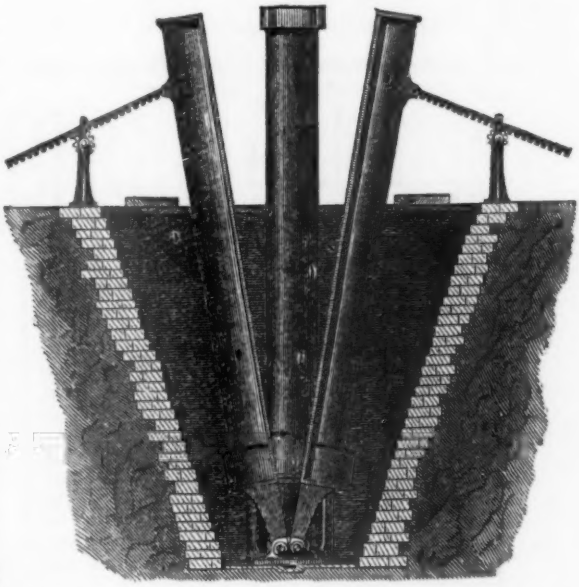


Fig. 3.



In illustration of what can be accomplished with fire-clay moulds, it may be mentioned that, at the present time of writing, upwards of eighty pipes have been cast in one single mould, and the process still goes on

with unfailing results in the shape of good pipes. It is at present impossible to see the end of this new system, but it must be obvious that a system whereby a mould once made, can be made to turn out so many of its counterparts, must be capable of withstanding a good many counterbalancing disadvantages on other points, even supposing such to exist.

For the Journal of the Franklin Institute.

Notes on the Performance of the Steamer Joseph Whitney, with a Comparison of her Performance with that of the Steamer Wm. Jenkins.

In the May number of this *Journal* will be found a carefully prepared detail of the performance of the steamer "*William Jenkins*," and we now propose to present a statement of the performance of her consort "*Joseph Whitney*," and for that purpose we have been furnished with her steam log, and the accompanying diagrams for a single run to Boston, during which time the attending circumstances of wind and sea, as well as the displacement of the ship, &c., were so similar to those attending the trips of the "*William Jenkins*," (the log which furnished the data for that investigation,) as to present a peculiarly favorable opportunity to arrive at a correct conclusion as to their relative efficiency.

In the present investigation, the effective pressure on the piston and the evaporation of the boiler, are both calculated from averages taken from diagrams Nos. 1, 2, and 3. The losses from oblique action of the wheels, are calculated in the usual way, viz: by taking the mean of the squares of the sines of the angles of incidence, at which the paddles strike the water. The following is the engineer's log for the run:

STEAM LOG—*Of Steamer Joseph Whitney, bound to Boston, March 28th*, 1857.

Date, &c., Mar. 28, 1857.	Average steam.	Cut-off per Card.	Vacuum.	Throttle valve.	Register.	Revolutions per hour.	Average revolutions per minute	Saturation.	Hot-well.	Average coal per hour.
M. 12	19	42	28½	Full.	474148		8·8		110°	1208·5
P. M.										
1	19	42	28½	Full.		529·2	8·8		110°	1208·5
2	"	"	"	"		"	"		"	"
3	"	"	"	"		"	"		"	"
4	"	"	"	"	476265	"	"		"	"
5	"	"	"	"		610·2	"		"	"
6	"	"	"	"		"	"		"	"
7	"	"	"	"		"	"		"	"
8	"	"	"	"	478706	"	"		"	"
9	"	"	"	"		600	"		"	"
10	"	"	"	"		"	"		"	"
11	"	"	"	"		"	"		"	"
12	"	"	"	"	481107	"	"		"	"
Av'ge.,	19	42	28½	Full.			8·8		110°	1208·5

Remarks.—28th March, ship's draft, forward 12 feet 8 inches, aft 13 feet 9 ins., dip of wheel 7 feet 8 ins.

At 12h. 26′, P. M., left the dock at Baltimore, weather pleasant.

STEAM LOG—*Of Joseph Whitney, bound to Boston, March 29th, 1857.*

Date, &c., March 29, 1857.	Average Steam.	Cut-off. per Card.	Vacuum.	Throttle valve.	Register.	Revolutions per hour.	Average Revolutions per minute.	Saturation	Hot-well.	Average coal per hour.
A. M.										
1	19	42	28½	Full.		592	9·8	1¾	110°	1208·5
2	"	"	"	"		"	"	"	"	"
3	"	"	"	"		"	"	"	"	"
4	"	"	"	"	483475	"	"	"	"	"
5	"	"	"	"		614	10·2	"	"	"
6	"	"	"	"		"	"	"	"	"
7	"	"	"	"		"	"	"	"	"
8	18	"	"	"	485930	"	"	"	"	"
9	"	"	"	"		593	9·8	"	"	"
10	"	"	"	"		"	"	"	"	"
11	"	"	"	"		"	"	"	"	"
12	"	"	"	"	488315	"	"	"	"	"
P. M.										
1	"	"	"	"		606	10·1	"	"	"
2	"	"	"	"		"	"	"	"	"
3	"	"	"	"		"	"	"	"	"
4	19	"	"	"	490740	"	"	"	"	"
5	"	"	"	"		"	"	"	"	"
6	"	"	"	"		"	"	"	"	"
7	"	"	"	"		"	"	"	"	"
8	"	"	"	"	493173	"	"	"	"	"
9	"	"	"	"		607	10·2	"	"	"
10	"	"	"	"		"	"	"	"	"
11	"	"	"	"		"	"	"	"	"
12	"	"	"	"	495617	"	"	"	"	"
Avg'e.	18·66	42	28½	Full.			10·3	1·75	110°	1208·5

Remarks.—March 29th. This day commences pleasant and calm, with a smooth sea. At 5h. 56′, A. M., passed out by Cape Henry. Register 484,660. At 2h. P. M., abreast of "Chincotique," latter part of this 24 hours light airs from W. N. W., fore and aft sails set.

STEAM LOG—*Of Joseph Whitney, bound to Boston, March 30th.*

Date, &c., March 30, 1857.	Average Steam.	Cut-off. per card.	Vacuum.	Throttle valve.	Register.	Revolutions per hour.	Average revolutions per minute.	Saturation	Hot-well.	Average coal per hour
A. M.										
1	19	42	28½	Full.		570·7	9·5	1¾	110°	1208·5
2	"	"	"	"		"	"	"	"	"
3	"	"	"	"		"	"	"	"	"
4	"	"	"	"	497900	"	"	"	"	"
5	"	"	"	"		584	9·7	"	"	"
6	"	"	"	"		"	"	"	"	"
7	"	"	"	"		"	"	"	"	"
8	"	"	"	"	500235	"	"	"	"	"
9	"	"	"	"		614	10·2	"	"	"
10	"	"	"	"		"	"	"	"	"
11	"	"	"	"		"	"	"	"	"
12	"	"	"	"	502690	"	"	"	"	"
P. M.										
1	"	"	"	"		619	10·3	"	"	"
2	"	"	"	"		"	"	"	"	"
3	"	"	"	"		"	"	"	"	"
4	"	"	"	"	505165	"	"	"	"	"
5	"	"	"	"		627	10·4	"	"	"
6	"	"	"	"		"	"	"	"	"
7	"	"	"	"		"	"	"	"	"
8	"	"	"	"	507675	"	"	"	"	"
9	"	"	"	"		630	10·5	"	"	"
10	"	"	"	"		"	"	"	"	"
11	"	"	"	"		"	"	"	"	"
12	"	"	"	"	510195	"	"	"	"	"
Avg'e.	19	42	28½	Full.			10·1	1·75	110°	1208·5

Remarks.—March 30th. This day commences pleasant with a smooth sea, and high easterly winds. At 1 h. 47′, A. M., Gay head abeam. Register 507,874; latter part of this 24 hours wind variable.

STEAM LOG—*Of Joseph Whitney, bound to Boston, March* 31, 1857.

Date, &c., Mar. 31, 1857.	Average steam.	Cut off. per Card.	Vacuum.	Throttle valve.	Register.	Revolutions per hour.	Average revolutions per minute.	Saturation.	Hot-well.	Average coal per hour.
A. M.										
1	19	42	28½	Full.		626	10·4	1¾	110°	1208 5
2	"	"	"	"		"	"	"	"	"
3	"	"	"	"		"	"	"	"	"
4	"	"	"	"	512700	"	"	"	"	"
5	"	"	"	"		631	10·5	"	"	"
6	"	"	"	"		"	"	"	"	"
7	"	"	"	"		"	"	"	"	"
8	"	"	"	"	515225	"	"	"	"	"
9	"	"	"	"		624	10·4	"	"	"
10	"	"	"	"		"	"	"	"	"
11	"	"	"	"		"	"	"	"	"
12	"	"	"	"	517721	"	"	"	"	"
P. M.										
1	"	"	"	"		631	10·5	"	"	"
2	"	"	"	"		"	"	"	"	"
3	"	"	"	"		"	"	"	"	"
4	"	"	"	"	520245	"	"	"	"	"
5										
Av'ge.,	17	42	28½	Full.			10·45	1·75	110°	1208·5

Remarks.—March 31st. This day commences and ends pleasant; light airs and smooth sea. At 4h. 43′ P. M., come to at the dock at Boston, running time 76 hours 17 minutes. Total number of revolutions made 46,536, and consumed 41 tons of coal. The following diagrams are placed in the order in which they were taken, and show the average performance for the run. Draft of ship on arriving at Boston, aft 13 feet 3 inches, forward 12 feet 3 inches.

From the foregoing log, the following summary of averages were taken :—

Average coal per hour,	1208·5 lbs.
" Steam per gauge,	18·915
" Cut-off (per cards),	42 inches.
" Revolutions per minute,	9·845
" Vacuum per gauge,	28½
" Temperature of hot-well,	110°
" Density of boiler water,	1¾

BOILER—One upper return flue.

Length,	28 feet.
Breadth,	14 ft. 9 ins.
Height exclusive of chimney,	10 ft. 2 ins.
Length of grate bars,	7 ft. 3 ins.
Diameter of smoke pipe,	55 ins.
Height of "	35 feet.
Total heating surface,	2303 sq. ft.
Total grate surface,	96 "
Fuel,	Bituminous coal.
Natural draft,	

Coal consumed per hour per square foot of grate surface 12·4 lbs.

With the above consumption of coal, and using 167·9 cubic feet of steam per stroke, (including space between valves, capacity of nozzles, and piston clearance), of the terminal pressure as taken from the diagrams, we have the evaporating efficiency of the boiler in its normal working condition (neglecting the losses arising from leakage and radiation,) as follows:—

$\frac{167{\cdot}9 \times 20{\cdot}4}{1932} = 1{\cdot}77$, and $\frac{1{\cdot}77 \times 60 \times 64{\cdot}3}{1208{\cdot}5} = 5{\cdot}65$ pounds of water evaporated to the pound of coal.

Loss from Blowing.—In order to maintain the water in the boiler at a density of $1\frac{3}{4} \div 32$, that is, $1\frac{3}{4}$ pounds of salt to 32 pounds of water, a loss is sustained as follows:—

$$\frac{1202 - 110° \times {\cdot}75}{115°} = \frac{1{\cdot}00}{7{\cdot}08} = 14{\cdot}1 \text{ per cent.}$$

The water thus blown out having been heated at an expense of 14·1 per cent. of the total amount of fuel consumed, and as we have seen that one pound of coal evaporated 5·6 pounds of water exclusive of radiation, &c., &c., it remains but to ascertain what amount of water should be evaporated by the 14·1 per cent. of lost fuel, in order to arrive at the true efficiency of the boiler, which is as follows: 100 : 5·65 :: 14·1 : ·769 and ·769 + 5·65 = 6·44 *pounds of water evaporated to the pound of coal as the total working effect of the boiler.*

The loss of power by filling the space between valves, nozzles, and clearance of piston, before the commencement of a revolution equals 5·1 horse power.

Performance of Engine.—The mean performance for the run of 76 h. 17 min., was as follows: $\frac{2123{\cdot}7 \times 21{\cdot}66 \times 224{\cdot}4}{33{,}000} = 312{\cdot}79$ the total developed horse power distributed as follows:—

Friction of engine,	5·00	per cent.	or	15·63	Horse Power.
" load,	4·50	"	"	14·07	"
To work air-pump,	4·60	"	"	14·34	"
Oblique action and slip,	23·78	"	"	74·66	"
Leaving to be utilized in propelling the ship,	62·12	"	"	194·09	"
	100·00	"	"	312·79	"

Coal consumed per hour per effective horse power 6·2 lbs.
Proportion of immersed sectional area to effective horse power 2 to 1.
Coal per mile, allowing the total distance to be 666, 137·9 pounds.

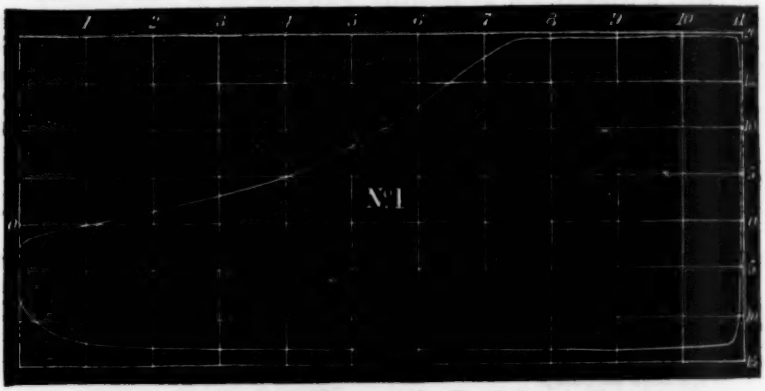
Having sufficient data for a comparison, we propose briefly to recapitulate a few of the conclusions arrived at, and place them in a convenient form for reference, from which it will be seen that of the two ships under consideration, the "*J. Whitney*," is the more economical vessel of the two, and such, I understand, is the fact in practice.

The difference, however, existing in their performance, must, we think, be attributed in part, if not entirely, to the superior model of the *Whitney*, as will appear from an examination of the following summary.

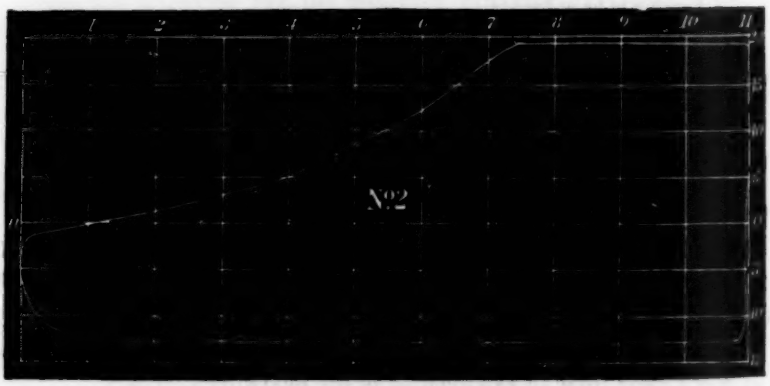
	WILLIAM JENKINS.	
Total per cent. of power developed,		100 or 458·439 H. P.
"	friction of engines, &c.,	41·1 or 188·442 "
"	utilized in propelling Ship,	58·9 or 269·997 "
		100·0
	JOSEPH WHITNEY.	
Total per cent. of power developed,		100 or 312·79 H. P.
"	absorbed in friction, &c.,	37·88 or 118·48 "
"	utilized in propelling ship,	62·12 or 194·31 "
		100·00

From the above it will be seen that the power utilized in propelling the "*William Jenkins*," exceeds that of the "*Whitney*" 28 per cent., while the latter, under the same circumstances of weather, &c., makes the quickest runs.

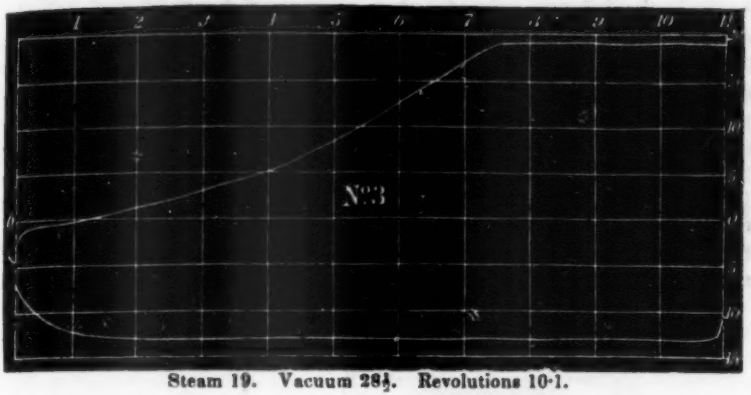
Scale 1-20=1 pound.



Steam 20 lbs. Vacuum 28½. Revolutions 10·5.



Steam 19½. Vacuum 28½. Revolutions 10.



Steam 19. Vacuum 28½. Revolutions 10·1.

Boilers.—Assuming the number of pounds of water evaporated in a boiler per pound of coal, to be the measure of its practical efficiency, we have as follows:—"*William Jenkins*'" boiler evaporates 8·79 lbs. of water to the pound of coal. The "*Whitney*" evaporated 6·44 lbs. of water to the pound of coal, showing the boiler of the former produces 26 per cent. better results than the latter.

J. Whitney.—Proportion of the immersed sectional area to effective horse power, 2 to 1.

Coal consumed per mile 137·9.

Coal consumed per hour per effective horse power 6·2 lbs.

William Jenkins.—Proportion of immersed sectional area to effective horse power, 1·4 to 1.

Coal consumed per mile 149·4.

Coal consumed per hour per effective horse power 6·1 lbs.

Specification of a Patent granted to CHARLES WILLIAM SIEMENS *and* JOSEPH ADAMSON, *of Leeds, for Improvements in Rotary Fluid Metres.* [Dated 24th March, 1853.]*

This invention relates principally to metres for measuring water, but it may also be employed for metres for measuring other fluids. In the following description certain materials are mentioned which are applicable to metres for measuring water and similar non-corrosive fluids.

In fig. 1, is a vertical section of one of the improved fluid metres, and fig. 2, is a plan view of the drum of the same. A, is the hollow drum having two tangential apertures *a*, *a*. The water or other fluid is introduced into the centre of this drum, and allowed to escape at the apertures *a*, *a*, and in its passage it causes the drum to revolve in the direction of the arrow, (see fig. 2.) The revolutions of the drum are registered by a counter at the upper part of the metre, which indicates the quantity of fluid passed through the metre.

B, is the outer cylindrical casing of cast iron screwed to the base-plate

* From Newton's Lond. Journal, January, 1857.

C; D, is the inlet opening for the entrance of the fluid, and E, is the outlet; F, is a circular chamber of white metal, such as pewter, with a bush of German silver in the centre, forming a bearing for the spindle G, of the drum A. H, is a cylindrical perforated ring or cage cast in one piece with the chamber F, and surrounded with wire gauze for the purpose of preventing the entrance of any solid matters which might choke the passages or obstruct the motion of the drum; I, is a flat disk or partition, with a cylindrical neck or pipe J, which enters the neck K, of the drum A. The top and bottom of the drum are curved, so that the fluid may flow in with as little obstruction as possible. A small flat piece of steel or agate *b*, is fixed to the lower end of the spindle G, and rests

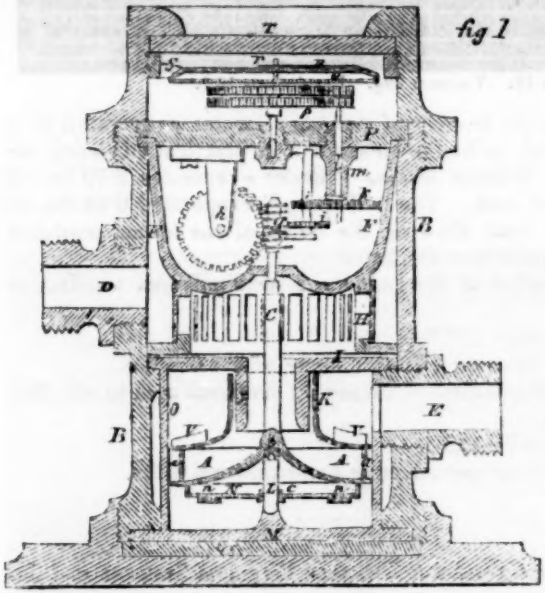


fig 1

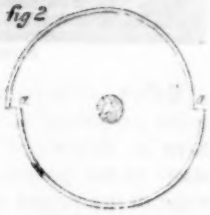


fig 2

fig 4

upon a round pointed piece of steel or agate at the top of the cylindrical stem L, which rises from the centre of the disk M. N, is a circular plate with the edges turned up and fixed to the drum A, so as to form a chamber, which is to be filled with oil when the metre is employed for measuring water; *n*, *n*, are apertures, with screw plugs, for the introduction of the oil. A bush *c*, is fixed in the centre of the plate N, to serve as a guide for the drum, and to prevent the escape of the oil. O, is a cylindrical lining, or inner case, forming a chamber in which the drum A, revolves; V, V, are small flat vanes or drag boards fixed on the drum A, for the purpose of somewhat retarding its motion. These vanes are of considerable importance, as without them the drum would make a greater number of revolutions, when a certain quantity of fluid is passed rapidly through it, than it would when the same quantity of fluid is passed slowly through it. The vanes V, experience a greater degree of resistance as the velocity increases, and thus serve to equalize the indications of the metre.

The spindle G, carries a screw *g*, at its upper end, which drives the worm-wheel *h*, on the axis of which is another screw for driving a worm-wheel *i*, on whose axis is a pinion *j*, driving the wheel *k*. The speed is thus reduced, so that the spindle *l*, of the wheel *k*, only makes one revolution for several hundred revolutions of the drum A. The spindle *l*, passes through a short tube or socket *m*, fixed to the plate P, and carries at its upper end a pinion *o*, which gears into the two wheels *p*, *q*, one of which, *p*, has one hundred and one teeth, while the other, *q*, has one hundred teeth. The upper one, *p*, is fixed to a short tube which carries the dial Q, while the lower wheel *q*, is fixed to the spindle, *r*, which carries the index R. Another index S, is fixed to the casing. The dial Q, is divided into one hundred parts, which are numbered in one direction on the outside, and in the opposite direction on the inside. The fixed index S, points to the units, while the movable index R, points to the hundreds. The units may be gallons, or hundreds, or thousands of gallons, or cubic feet, or other integer. The dial is protected by a strong glass plate T.

The spindle *l*, has a conical shoulder, which is pressed up to the end of the socket *m*, by the pressure of the fluid, which is thus prevented from escaping.

The chamber F, is filled with oil so as to keep the wheel-work lubricated, and prevent the entrance of the fluid which is being measured. The drum A, may be made with three, four, or more apertures, in lieu of the two apertures *a*, *a*. Or, in lieu of a drum, two or more hollow arms or spokes, with tangential apertures at the ends, may be employed.

Fig. 3, is a vertical section of another form of the improved fluid metres. Fig. 4, is a plan view of the wheel which measures the fluid, and of the channels or guide curves which conduct the fluid to it.

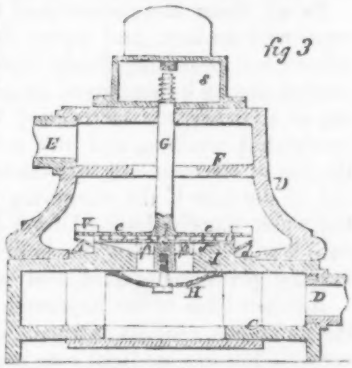


fig 3

A, is a wheel mounted on a spindle G, and consisting of a flat disk *a*, and a conical ring *d*, with a number of straight or curved blades *e*, *e*, between them. The spindle G, turns upon a pin *b*, at the lower end, and upon another pin *s*, at the upper end. Within this wheel is a circular block I, and a disk J, between which are several blades *f*, *f*, curved or inclined in the opposite direction to the blades *e*, *e*. B, is the casing which is fixed upon the hollow base C, C. D, is the inlet, and E, is the outlet. H, is a perforated plate or strainer to prevent solid matters from entering the wheel. There is an opening in the bottom of the base for the removal of any solid matters, which opening is closed by a plate. F, is a partition in the upper part of the casing, with a circular aperture in the centre. The water or other fluid enters the base C, by the inlet D, and ascending through the perforated plate H, passes between the guide-blades *f*, *f*, and impinges upon the blades *e*, *e*, of the wheel A, and causes it to revolve. The fluid ascends through the aperture in the partition

F, and escapes at the outlet E. The partition F, serves to prevent the establishment of unequal currents from different parts of the wheel to the outlet. The number of revolutions of the wheel A, is registered by means of wheel-work, and a dial or dials, as in the metre, shown in fig. 1, or as employed in gas metres or other apparatus in which counters are used. Small vanes V, V, are fixed on the top of the wheel A, for the purpose of somewhat retarding its motion, as in the metre shown in fig. 1.

The patentees show a modification of this metre, in which the inner set of blades is made to revolve. This arrangement has an internal movable wheel, consisting of a disk and blades as before, with the addition of another circular plate with a neck. The inner wheel revolves round a fixed pin, on the top of which the outer wheel revolves. The remainder of the metre is similar to that shown in fig. 3. The wheels will revolve in opposite directions when the fluid passes through them, and they may either be allowed to revolve independently of each other, or they may be geared together so as both to act upon the counter. The metre may also be arranged so that the fluid may enter at E, and escape at D; and the motions of the wheels will then be reversed, and the graduations on the dial or dials must be made to correspond. The outer wheel may also be fixed, and only the inner one allowed to revolve; its revolutions being registered by connecting the counter to it.

In all these arrangements of metres, the apparatus is enclosed in a case with an inlet and outlet opening, so that the metre may be employed for measuring fluids under pressure. Thus, if one of the improved metres be employed for measuring the water supplied to a dwelling or a factory, the metre may be placed on the ground floor or other convenient position, and the outlet pipe from it may be carried up to the top of the building, or wherever the water is required. This would not be the case if the measuring wheel were not inclosed in a case, and the water merely dropped from it into a cistern. The omission of the case would also render the indications of the metre less accurate under varying pressures of fluid, and would also increase the friction.

Another form of the improved metre for measuring fluids, adopted by the patentees, consists of a paddle-wheel, with straight or curved blades revolving in the air-tight case provided with inlet and outlet passages. The upper part of the case is filled with compressed air or other suitable gas, which prevents the liquid from rising into it. The liquid thus flows through the lower part of the case, and carries round the paddle-wheel with it. The revolutions of the paddle-wheel are registered by a counter, as in the other metres hereinbefore described.

By simply inverting this apparatus it may be employed to measure fluids lighter than that contained in the chamber, provided they do not mingle together. Thus by filling the chamber with water, it may be employed for measuring air,—and by filling the chamber with mercury, it may be employed for measuring water.

The invention relates also to improvements in certain varieties of fluid metres constructed with screw drums, and described in the specification of a patent granted to Mr. Siemens, 15th April, 1852.

In some of the modifications of this metre two screw drums are em-

ployed, the first of which is allowed to revolve freely, while the second drum is connected to the counter. As an improvement, the patentees apply the vanes or drag-boards to the first screw drum, so as to retard it somewhat, and cause the fluid to impinge with greater effect upon the second or registering drum.

Screw metres may be constructed in which the first screw is fixed; and the second or registering screw drum is provided with the vanes or drag-boards, to produce a greater resistance at high velocities than at low velocities.

This metre may be modified so as to relieve the spindle of the screw drum from end pressure, by employing a long drum having a right-handed screw upon one end, and a left-handed screw upon the other end, with the vanes or drag-boards in the centre of the intermediate space. The fluid is then admitted through left-handed and right-handed screws fixed at opposite ends of the case of the metre, and is conveyed away from the centre of the case.

The patentees claim, "Firstly,—the construction and arrangement of rotary fluid metres, with a revolving wheel or wheels connected with a counter and inclosed in a case, and so arranged that the fluid to be measured flows from the centre towards the circumference, or from the circumference towards the centre of the wheel or wheels, in manner hereinbefore described in reference to figs. 1, 2, 3, and 4. Secondly,—the construction of fluid metres with a paddle-wheel connected with a counter, and revolving in a chamber containing another fluid, which is not miscible with the fluid to be measured, as hereinbefore described. Thirdly,—the application to rotary fluid metres of vanes or drag-boards, in manner hereinbefore described."

Specification of a Patent granted to Edward Aldridge, *of Boston, Lincolnshire, for improvements in metres for measuring the flow of liquids and fluids, which can also be employed for obtaining motive power, and in taps for regulating the flow of liquids.*—[Dated 25th May, 1855.]*

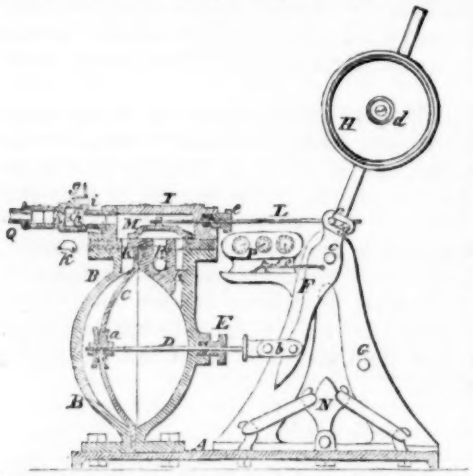
This invention of improvements in water metres consists in the employment of a flexible diaphragm fitted inside a spherical or other suitably shaped vessel, into which water, gas, or other liquid or fluid is alternately admitted or expelled through a slide, similar to the slide-valve of a steam engine, and which is worked by a rod passing through a stuffing-box at one side of the vessel and connected to the flexible diaphragm. The quantity of liquid or fluid passing through the vessel may be registered by any suitable registering arrangement, worked by the rod which sets the slide in motion.

The improvement in taps for regulating the flow of liquids into or from such metres as aforesaid, and for regulating the flow of liquids generally, consists in casting upon a shaft, or otherwise fitting thereon or thereto, a cam or eccentric, which bears upon the spindle of a valve which is kept in its seat and closed by a pressure of liquid upon it. On turning the shaft, the rise of the cam forces back the spindle and valve,

* From Newton's Lond. Journ., January, 1857.

and opens a small or wide passage for the liquid, according to the swell of the cam and the amount of turn given to the shaft.

The cut represents a sectional elevation of the improved metre. A, A, is a cast iron bed or base-plate, for supporting the working parts of the metre or engine, when this apparatus is used as such. B, B, is a metal spheroidal vessel, formed in two parts or halves, bolted together; C, is a flexible diaphragm, the edge of which is inserted between the halves of the vessel B, and the whole bolted together; D, is a rod fixed to the diaphragm C, by means of two plates *a*, *a*, tapped and screwed on each side of the diaphragm. This rod works through a stuffing-box E, in the side of the vessel, and is connected by the links *b*, to the lever F, centred on a projecting stud-pin *c*, fixed in a standard or bracket G, bolted to the base-plate A. At the top of the lever F, is fixed a balance weight H, having a set-screw *d*, passing through it to the lever, by means of which the balance weight can be set at any required position upon the lever, according to the pressure of the liquids. I, is a valve-box, fitted on the top of the vessel B; and K, K, are passages which alternately form the in-flow, and outlet for the liquid or fluid; L, is the valve-rod which passes through the stuffing-box *e*, and is connected at one end to the slide-valve M, and at the opposite end to the lever F, by means of a cross-head *f*, working in slots *g*, in a forked part of the lever F, as shown,—so that the lever may have a greater stroke than the valve-rod L. N, is a short lever, working upon a joint fixed to the base-plate A, and fitted with two flexible springs of vulcanized india-rubber or other material. This lever and springs are to prevent the lever F, from falling over directly it has passed the vertical line, and serve, in combination with the slots *g*, to keep the valve open until the vessel B, is filled with the liquid or fluid; after which the lever F, is liberated from the lever N, and the sudden jerk caused by the falling of the lever F, and balance weight, gives to the cross-head *f*, a blow sufficient to reverse the slide, and allow the water or other liquid or fluid in the vessel to flow out, and a fresh charge to flow in. O, is a rod fixed in a stud-pin in the lever F, and is for the purpose of giving motion to the registering apparatus P; Q, is the inlet pipe to the vessel B, which is fitted with the improved regulating tap; *g*, is a spindle or shaft, having a cam or eccentric *h*, (see the detached view) cast upon it, or otherwise fitted thereto. The spindle *g*, works in a step in the body of the tap, and the top part passes through the screwed cap *i*. *k*, is a spindle-valve, which is fitted into its seat with the back part towards the pres-



sure, the spindle of the valve working up against the lower side of the cam. On turning the spindle *g*, the rise on the cam forces back the valve, and thereby admits the inflow of the water. When the cam ceases to act against the spindle of the valve, the pressure of the liquid or fluid serves to keep the valve close in its seat. R, is the out-flow pipe, fitted with a similar valve and cam to those just before described. To employ this metre as a motive power engine, the rod D, passing through the side of the vessel containing the diaphragm, has to be connected to the machinery to be worked. An engine may have two rods working in the same line connected to the diaphragm, one passing through one side and the other through the opposite side of the vessel.

The patentee's claims are, "First,—the improved arrangement and construction of metres for measuring the flow of liquids and fluids, as hereinbefore described and represented in the drawings hereunto annexed. Second,—I claim the adaptation to and employment of my improved metre, represented in the drawings hereunto annexed, as a motive power engine, arranged and modified in manner hereinbefore described. And, third,—I claim the improved construction of tap or valve for regulating the flow of liquids or fluids, as hereinbefore described and represented in the drawings hereunto annexed."

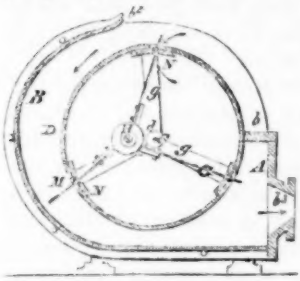
Specification of a Patent granted to AUGUSTA EDOUARD LORADOUX BELLFORD, *of Strand, for certain improvements in rotary blowing machines; which are also applicable to rotary pumps, to rotary engines to be driven by steam or other fluids, and to metres for measuring the flow of fluid bodies,—being a communication.*—[Dated 26th June, 1855.]*

This invention relates, firstly, to the method of operating the fans, buckets, or sliding pistons, as they may be variously termed, according as they belong to a blowing machine, a pump, or an engine; and consists in the employment of a drum arranged so that it may be rotated upon its axis, and having slots or openings through its periphery for the fans, buckets, or sliding pistons, in combination with the arrangement of the fans, buckets, or pistons upon an independent axis inside the drum, but eccentric to the axis thereof; so that as the drum is revolved, the fans, buckets, or sliding pistons are projected beyond the surface of the periphery of the drum at one side to fill the case surrounding it, and at the other side are drawn within the periphery of the drum. Secondly, to the use of a roller packing for the aforesaid fans, buckets, or pistons, at the point where they pass through the slots in the periphery of the drum.

The sectional figure illustrates the invention as applied to a blowing machine. A, is the frame, supporting two fixed axles C, C, which form the axis of the drum; B, is the shell or case of the blowing machine. At the top of this case is an open space b^2, for the ingress of air, and at the lower and front side of it a discharge opening b^3, at which the blast is given out to be conveyed to the furnace or other place where required. Between these openings there is an abutment *b*, forming part

* From Newton's Lond Journ., Jan., 1857.

of the case, extending inwards to the periphery of the drum, and separating the induction opening b^2, from the eduction opening b^3. The drum D, fits to work easily and without friction in circular openings in the ends of the case B, and is hollow and open at the ends, having a hub at each end, connected to its periphery by arms g, g. The hubs are bored to fit as boxes to the fixed axles C, C, on which the drum is to be rotated by power applied in any suitable way to its axis. In the periphery of this drum are cut three longitudinal slots F, F, F, to allow



the fans G, G, G, of the blower, arranged within the drum, to pass through them, and as the drum rotates on its axis, to carry with it the said fans, which are arranged on a fixed axle H, eccentric to the axis of the drum, and consequently to project them at one side beyond the periphery, and at the opposite side draw them within the periphery of the drum; so as to carry around the back of the blowing machine a full blast of air, and discharge it at the front side free from any serious back action. Connected to the fixed axle H, are arms d, d, to which the axles C, C, are attached. The fans to the axle H, are attached to boxes which are fitted to turn freely on the said axle. The fans are packed in the slots F, F, where they pass through the drum, each by a cylindrical piece of metal M, having a longitudinal slot, through which the fan passes, and being secured in a box N, on the inner side of the periphery of the drum. As the fans are consequently changing their angle with the periphery of the drum as the drum rotates, these cylindrical packing pieces M, have a rolling motion in their boxes N.

The construction and operation of a blowing machine having been described, the application of the invention to pumps, rotary engines, and fluid metres, will be easily seen. For any of these purposes the construction of a machine may be in all respects like the blowing machine above described, except that in place of the wide opening b^2, there will be simply a pipe for the induction of water, steam, or other fluid. The operation of a pump will be substantially like that of the blowing machine, but in an engine or fluid metre will be precisely the reverse, the incoming steam or fluid acting upon the fans (which would then, more properly speaking, be sliding pistons), and thereby giving motion to the drum D, and the shaft C.

The patentee claims,—"First, the arrangement of the fans, buckets, or sliding pistons G, G, G, upon an axis H, arranged within a drum D, and eccentric to the axis C, of the said drum; whereby the said fans, buckets, or sliding pistons may be revolved by the said drum, or may be acted upon by steam or other fluid to revolve the said drum, and by the said revolution may be projected beyond the periphery of the drum at one side to fill the casing by which the drum is surrounded, and at the other side may be drawn within the periphery of the drum, substantially as and for the purpose hereinbefore set forth. Second,—the cylindrical adjustable packing M, applied substantially as herein set forth, in combination with the fans, buckets, or sliding pistons G, and the drum D."

*On Soluble Glass, its Preparation and Applications.**

By. J. N. von Fuchs.

In the introduction to this memoir the author refers to the length of time that his discovery, which was made in 1825, remained unnoticed, being at first declared of no consequence, and even attacked. Before his departure from the world, as the celebrated author says, he feels himself impelled, now that the importance of this discovery has been recognised, to publish another series of observations in this memoir. In the first section the author describes the mode of preparation of the four different kinds of soluble glass, the nature and employment of which were treated of by him in his previous papers. These are :—

1. *Soluble Potash Glass.*—This is prepared with—

15 parts of powdered quartz or pure quartz-sand,
10 " well-purified potashes,
1 " powdered charcoal.

On a large scale we may take

45 pounds of quartz,
30 " potashes,
3 " charcoal powder.

These ingredients are well mixed and fused for five or six hours in a fire-proof glass crucible with a strong fire, until the whole has reached a uniform and quiet fluid state, for which purpose no lower temperature is required than that for the fusion of ordinary glass. The fused mass is then taken out with iron ladles, and the crucible again filled with a new charge.

The glass thus obtained is pulverized, and gradually put into about five parts of boiling water in an iron kettle; it is constantly stirred, and fresh hot water is frequently added to replace that which evaporates, and the whole is kept uninterruptedly boiling until it is dissolved, with the exception of a muddy deposit, and a tough film capable of being drawn out into threads is formed upon the surface; (this takes from three to four hours.) This film indicates that the solution is approaching concentration; it disappears again, however, when it is immersed, after which the boiling is continued for a short time, in order to bring the solution to the proper state of concentration, in which it has a specific gravity of 1·24 to 1·25. At this strength it is still tolerably fluid, and capable of being employed at once in many cases; for certain purposes, however, it must be diluted with more or less water. It may also be evaporated further until it reaches the consistence of a syrup, but it can then only be employed with advantage in particular cases.

When, as is not unfrequently the case, it contains some sulphuret of potassium, some oxide of copper, or copper scale is added towards the end of the boiling, in order to destroy it; by this means a small portion of potash is set free; but this is not only not injurious for most technical purposes, but is even advantageous in many. But if it be desired to have a soluble glass completely saturated with silica, it must be boiled with freshly-precipitated silica until no more of this is dissolved.

* From the Lond. Chem. Gaz., No. 347.

To facilitate its transport, it may be evaporated with constant stirring until it forms a soft mass; and the best vessels for packing it are made of tinned iron. A better and more ready means of preparing it in the solid state is furnished by alcohol. Thus, if the concentrated solution be mixed with one-quarter volume of rectified alcohol, a gelatinous precipitate is produced; this in the course of a day or two contracts strongly, and adheres firmly to the bottom of the vessel. If the supernatant fluid, which not unfrequently contains besides some carbonate of potash, traces of chlorides of potassium and sodium and sulphuret of potassium, be poured away, and the precipitate washed with water and slightly pressed, the soluble glass is obtained in a solid state, very pure, and completely saturated with silica. It is readily and perfectly soluble in water. When the expression soluble glass alone is used in the following pages, the potash glass is always to be understood.

2. *Soluble Soda Glass* is prepared from

45 pounds of quartz,
23 " anhydrous carbonate of soda,
3 " charcoal powder.

This mixture is somewhat more readily fusible than the potash-glass. It may be most cheaply prepared, however, as Professor Buchner has ascertained, by means of Glauber's salts, for which purpose take

100 parts of quartz,
60 " anhydrous sulphate of soda,
15–20 " charcoal.

The product, when completely saturated with silica, furnishes with water a somewhat more opalescent solution than that prepared with potash at the same degree of concentration.

It is not precipitated completely at once by rectified alcohol, like the potash-glass, but only converted into a gelatinous mass; when it is not completely saturated with silica and somewhat diluted, it either gives no precipitate, or only furnishes one after some time, by which it may be easily recognised and distinguished from the potash-glass.

3. *Double Soluble Glass.*—Potash and soda-glass may be mixed together in all proportions, but we can only regard as a normal double glass that which contains equal equivalents of potash and soda, and which may be obtained with certainty with Rochelle salt and the requisite quantity of quartz (100 parts of quartz to 121 parts of Rochelle salt). But this is too expensive for technical purposes, and it may be prepared much more cheaply with equal equivalents of nitrates of potash and soda, or purified tartrate of potash and nitrate of soda, and the corresponding quantity of quartz; this is of sufficiently good quality for technical purposes. It may also be prepared by the direct fusion of quartz, carbonate of potash, and carbonate of soda, according to the following recipe:—

100 parts of quartz,
28 " purified potashes,
22 " neutral anhydrous carbonate of soda,
6 " charcoal powder.

It fuses perceptibly with greater ease than either of the preceding.

As it is of no consequence for technical purposes to have an exact quantitative proportion, it will not be far wrong to mix 2 parts by measure of concentrated soda-glass with 3 parts by measure of potash-glass; this will give a double glass which is applicable to all technical purposes, for which it is found to be particularly adapted.

4. *Soluble Glass for Fixing.*—The ordinary soluble glass is not adapted to stereochromic purposes; the figures which are fixed by it acquire spots. Soluble glass for this purpose is prepared by fusing together 3 parts of pure anhydrous carbonate of soda with 2 parts of powdered quartz. Of this a concentrated solution is made in water, and 1 part by measure of this is mixed with 4 to 5 parts by measure of concentrated potash-glass completely saturated with silica, by which means, besides an increase of silica, it acquires a larger amount of alkali which is sufficient to prevent its rapid decomposition, without perceptibly altering its other properties. The soluble glass which was previously turbid or opalescent, becomes perfectly limpid and rather more fluid by this means. The use of this mixture is not limited to stereochromy, but it may also be applied with advantage to many other purposes.

Properties of Soluble Glass, and its behaviour to other Bodies.—The solid, or fused soluble glass, which, when pure, has the appearance of ordinary glass, dissolves gradually in boiling water, without leaving a residue; in cold water, however, the solution takes place so slowly, that it might almost be supposed to be quite insoluble therein. It is, however, quite insoluble only when a much larger quantity of silica is combined with it, or a part of its potash is extracted from it, or when other bodies, such as earths, metallic oxides, &c., are present in it, which combine with it to form triple or double salt-like compounds, such as we meet with frequently in the mineral kingdom: common glass is also a compound of this nature. It must be observed, in passing, that silica generally combines rather with two bases than with only one.

Acids, even including carbonic acid, decompose the solution, and separate the silica in the gelatinous form. They act still more strongly and rapidly, even when diluted, upon the solid soluble glass, and separate the silica from it in the pulverulent form.

Salts with alkaline bases, especially carbonates and muriates, produce pasty precipitates, which are formed immediately, and coagulate the whole fluid when it is not too much diluted; otherwise they only make their appearance slowly. In this respect muriate of ammonia is peculiarly active, and produces a flocculent precipitate, with evolution of ammonia, even when the solution is greatly diluted: this precipitate, when washed for a long time with water acidulated with nitric acid, leaves pure silica.

The alkaline earths set free more or less potash from the solution, and combine with the silica and the rest of the potash to form double compounds, which are completely insoluble in water.

Alumina also combines with it to form a product insoluble in water, for which reason it is necessary to see that the quartz-sand which is employed in the preparation of the soluble glass bears no argillaceous particles with it. The insoluble paste produced in the solution of the fused glass probably arises principally from the alumina taken up by the glass

from the melting pot. If soluble glass be exposed to the air in solution in open vessels, it attracts carbonic acid, and undergoes decomposition, so that it coagulates in a longer or shorter time, and a gelatinous deposit gradually forms, which, according to Buchner's investigation, contains potash.

With the aid of heat, this change takes place much more rapidly than at the ordinary temperature; and if the solution be gradually evaporated in a dish on the evaporating furnace, and at last exposed to a stronger heat, in order to render it anhydrous, during which operation it becomes strongly inflated into a pumice-like mass, it is found afterwards to be for the most part decomposed, rendered insoluble in water, and capable of effervescing strongly with acids. By a slight red heat, however, it again returns to its original state, so that it may be completely dissolved in water.

From this it appears that when it is desired to prepare soluble glass in the solid state from its solution by evaporation, it must be kept constantly boiling, when the access of the carbonic acid is prevented by the steam. The same thing has to be taken into consideration in the solution of the crude fused glass; for which reason cold water must not be employed to replace that which is evaporated, because otherwise the boiling would be interrupted, and the access of carbonic acid would be permitted.

When solid, pulverized, soluble glass is exposed for some time to the air, it undergoes the same alterations as during evaporation; thus it effervesces strongly with acids, and only dissolves partially in water, leaving a strong sediment. But if the powder be calcined, it again dissolves completely. If drops of it be let fall upon the table or the floor, they soon lose their transparency, and become white, in consequence of partial decomposition. The same thing takes place when it is poured out of a glass vessel, in which case some of it frequently runs down on the outside, and remains adherent; it then soon after drying, forms white streaks, which cannot easily be got rid of. If it be preserved in a glass vessel which is not quite full or well stopped, a white ring is produced in course of time, and this adheres so firmly that it cannot be entirely got rid of, even with acids. At the same time a more or less considerable precipitate is formed at the bottom of the vessel.

If concentrated soluble glass be laid upon a solid material which imbibes it very little or not at all, such as glass, marble, thick paper, &c., it soon dries and forms a shining transparent varnish, which, however, does not long remain in this state, but gradually becomes dull, turbid, and sometimes cracked, and at last acquires a delicate dusty coating. This alteration is due to the fact that air-dried soluble glass still contains much water (about 12 per cent.), which it only loses slowly; and during this it always contracts more and more, and acquires considerable hardness.

One of the most excellent and important properties for technical purposes possessed by soluble glass, is that of binding and rendering coherent; it serves therefore to give loose masses density and a stronger cohesion, to unite separate parts of bodies, to combine small fragments into a larger whole, to fill up clefts and cracks, &c., in which direction

it has by no means attained all the applications of which it is capable. In this respect it may be compared with glue, and it might be called mineral glue.

Its efficacy is shown immediately when it is incorporated with solid and porous bodies which imbibe it, and when it is brought in contact with pulverulent, dusty, or sandy bodies, or such as may be crushed between the fingers; by this means these are converted into stony masses, and at the same time the glass loses its solubility in water.

These actions are dependent as to their degree upon the nature of the substances with which the soluble glass is brought in contact, as some attract and unite with it more strongly than others. In this respect the essential difference occurs, that with some, such as magnesia and oxide of zinc, a chemical combination takes place with the glass, whilst in other cases the only action is that of the adhesive power.

In the former the actions, namely hardening and insolubility, are easily intelligible, as an insoluble product is formed by the reception of a second base; in the latter it is not so easy to understand the process, especially as the behaviour of the soluble glass to bodies of different kinds differs considerably; for which reason also it is by no means a matter of indifference what body is selected when it is desired to prepare an intimate, solid, water-proof mixture. Thus, soluble glass gives a much greater adhesive tendency to powdered marble than to powdered quartz. That the carbonic acid of the air assists greatly in the consolidation of soluble glass is evident even from what has already been said regarding its partial decomposition by the action of the air: this, however, does not appear sufficient to explain the remarkable change which is often perceptible even in a few days. Carbonic acid certainly loosens the otherwise weak union between the silica and alkali; but, in the author's opinion, the silica does not behave passively, but, in accordance with its very peculiar nature, spontaneously acquires various states of coherence, and even assists actively, itself contracting, so to speak, and at the same time uniting so firmly with the bodies in contact with it, towards which it has a coherent tendency, that the whole becomes, as it were, petrified. With a mixture which does not bind in the desired manner, it is only necessary to add some material which enters into a chemical combination with the soluble glass, when the desired result is certain to be attained.

A good binding mixture of pulverulent or sandy materials with soluble glass, is called *soluble-glass mortar* by the author. In many cases, as we shall see hereafter, it may be employed with great advantage instead of the ordinary lime-mortar.

(To be Continued.)

Caselli's Pantographic Telegraph.

This instrument described in the *Bibliotheque Universelle de Geneve*, produces a fac-simile of the hand-writing of the dispatch. It is simply the instrument invented by Mr. Bain, a model of which was exhibited before the Franklin Institute by Dr. Swaim. The only novelty in this

reproduction is the mode of regulating the motion of the cylinders at the ends of the line, which is here done by electro-magnets, and was by Mr. Bain much better done by accurately adjusting two second pendulums. So high an authority as Prof. Dela Rive should be cautious how he lends his approbation to such pseudo-inventions.

To the Committee on Publications of the Franklin Institute.

GENTLEMEN :—Accompanying I submit for your examination, a report of experiments on wood gas, made in the retorts invented by me; also, a statement of the results of the operations at the Philadelphia Gas Works for the month of June of the present year. If you deem it worthy of publication, you will please order its insertion in the *Journal of the Institute.*

Very respectfully,

C. M. CRESSON.

Report of Experiments on the Value of Wood Gases.

Messrs. JOHN C. CRESSON, CHAS. M. CRESSON, and LEMUEL H. DAVIS.

GENTLEMEN:—We herewith submit to you our Report on the value of wood gases. Our investigation consisted, first, in careful analysis of pine and oak wood gases; and secondly, in photometrical measurements, executed with great care and fidelity, and showing the illuminating power of the two varieties of wood gas in terms of the standard sperm candle. The wood gases analysed by us were collected in Philadelphia, in glass tubes carefully sealed before the blowpipe, and which, on examination previous to the analyses, were found to be free from flaws and perfectly tight. The pine wood gas was collected February 1st, and the oak wood gas February 2d. Both gases were manufactured at the old city or 9th Ward Gas Works, in retorts of the form patented by Dr. C. M. Cresson.

The pine wood employed was the so-called, "old field Virginia pine," cut a little over one year, and dried in the arches under the retorts, the temperature being about 60° Fah. It was probably not drier than wood dried under a shed. The oak wood was of the second growth, in small sticks, and of ordinary quality.

Both gases were purified by dry lime alone. The analyses were made in New York; the photometric measurements in Philadelphia, February 13th and 14th. In our analyses we have exclusively employed the method first introduced by Bunsen, and since then used by Frankland, Wetherill, and other chemists in pursuing similar investigations. We have satisfied ourselves by direct experiments, that this is the only one capable of yielding accurate results. The absorption of olefiant gas and hydro-carbon vapors by means of Bromine, appeared to furnish so rapid and simple a mode of determining these substances, that we considered it necessary to pay particular attention to this point. Experiments, however, showed that, while the method, when skilfully employed, does yield results of sufficient accuracy for ordinary purposes, it is far from giving the precision required in scientific investigations. In like manner, we have found that the absorption of carbonic oxide by a solution of

subchloride of copper in hyprochloric acid is not to be relied upon when great accuracy is desired.

The specific gravities of the gases were determined in the usual manner, without previous drying.

The following are the analytical results obtained expressed in volumes:

Pine wood Gas.	Spec. Grav.= 0·663	*Oak wood Gas.*	Spec. Grav.= 0·580
Hydrogen,	=32·71	Hydrogen,	=30·44
Light Carburetted do.	=21·50	Light Carburetted do.	=33·12
Olefiant gas and Hydro-carbon vapors,	=10·57	Olefiant gas and Hydro-carbon vapors,	= 6·46
Carbonic oxide,	=27·11	Carbonic oxide,	=26·11
Carbonic acid,	= 4·90	Carbonic acid,	= 0·48
Oxygen,	= 0·66	Oxygen,	=none.
Nitrogen,	= 2·55	Nitrogen,	= 3·39
	100·00		100·00

The photographic measurements were made in the dark chamber of the laboratory of the old City Gas Works in Philadelphia. Ritchie's photometer was employed, the standard being a sperm candle burning 120 grains per hour. It is also proper to state that the wood gases used in all these experiments flowed through about 500 feet of pipe before reaching the burners, about one-half of the pipe being exposed to the air of the atmosphere, while the other half passed through a cellar. The gas, as in the cases of that taken for the analyses, was the average of eight retorts with four hours charges.

The photometrical experiments were made by both of the chemists reporting to you, and are believed to be entirely reliable, every care having been taken to secure accuracy. The wood gas was, of course, burned from its own burner.

The experiments with the pine wood gas were made when the temperature of the atmosphere was 15° F., and the temperature of the cellar through which one-half of the supply pipe passed, 45° F.

The first series of nine experiments gave for the pine wood gas, when burning at the rate of 4·6 cubic feet per hour, an average illuminating power of 18·3 standard sperm candles; when burning at a consumption of five feet per hour, the average illuminating power was 18·2 candles.

The experiments with the oak wood gas were made when the external temperature was 15° F., and the temperature of the gas itself 48° F.

The mean of 10 careful determinations gave an illuminating power of 19·17 candles.

It will be remembered, that the average illuminating power of the Philadelphia City gas is between 17 and 18 standard candles.

As the circumstances under which both series of photometric determinations were made, were in all respects unfavorable to the wood gas, these results are to be considered as below a fair average. It is proper also to state that photometric measurements made with both kinds of wood gas, at the time when the two gases were collected for analyses, gave for the oak gas an illuminating power of 27 candles, the average of five observations; for the pine gas an illuminating power of 31 candles in one experiment.

In conclusion, gentlemen, we have only to express in a few words

the opinion which our experiments have compelled us to adopt, namely, that wood gas illuminating power is fully equal to the average of coal gas. All of which is respectfully submitted.

We submit also for your inspection, the results of our analysis of the gas of the Manhattan Company, in the City of New York, which, perhaps, may not be without interest. This gas was collected in the laboratory of the Free Academy, on the evening of February 5th.

Hydrogen, . .	= 42·98
Light carburetted hydrogen,	= 40·11
Olefiant gas and hydro-carbon vapors,	= 10·54
Carbonic oxide, . .	= 3·48
Carbonic acid, .	= 1·06
Oxygen, . .	= none.
Nitrogen, . .	= 1·83
	100·00

The specific gravity of the gas was 0·570.

WOLCOTT GIBBS,

Prof. of Chemistry and Physics in the Free Academy in New York.

Philadelphia, February 14, 1856. DR. F. A. GENTH.

—

The results tabulated below, are taken from the books of the Philadelphia Gas Works. The product is from three beds of cellular retorts, with three retorts in each. In two of the beds, the retorts are adapted to the use of wood 6 feet in length, the others to lengths of 8 feet; the latter requires no more labor or fuel than the former, whilst the product is one-third greater. In case of renewal, it is proposed to make all the retorts of capacity sufficient for 8 feet lengths, when a greater economic result may be expected.

The wood for carbonization and fuel, is of the variety known in this market as "shore pine," and is of a decidedly inferior quality, it is freshly cut and exposed to the weather. Much better results are obtained during a dry season, both as regards the make of gas and quantity of lime required for purification. It is decidedly to the interest of the manufacturer to purchase well seasoned wood, and protect it by proper shedding. Should a future opportunity offer, the results of experiments upon various kinds of woods, as well as an average of the products, and also a maximum working for a considerable period will be given in like form, from which a much better idea of the commercial value of the apparatus may be derived. The cost per thousand it may be perceived, by the use of this apparatus, is considerably below that of coal gas, whilst the light produced foot per foot is almost identical. The hydrate of lime which is employed in purifying, is converted into a carbonate, and may be restored and re-used by burning in a suitable kiln and slaking. The demand for the by-products has, so far, exceeded the supply; but should they at any time become unsaleable, the cost of the gas would be about one dollar per thousand feet without making any reduction for the value of the charcoal as fuel.

Operations in Wood Gas for the month of June, 1857, at the Philadelphia Gas Works.

Date.	Wood carbonized. lbs.	Gas produced, cubic ft.	No. of retorts in action.	Wood used as fuel. lbs.	Bushels of lime to purify.	Make in feet per lb.
1	5850	30000	6	4000	48	5·11
2	5250	26000	6	4667	48	4·95
3	6300	29000	6	5333	48	4·60
4	6300	27000	6	5333	48	4·28
5	6300	27000	6	5333	48	4·28
6	9000	40000	9	5333	48	4·44
7	9000	44000	9	5333	72	4·88
8	9000	47000	9	5333	48	5·22
9	9000	44000	9	5333	72	4·88
10	9000	48000	9	5333	48	5·33
11	9000	45000	9	5333	72	5·00
12	9000	43000	9	5333	48	4·77
13	9000	44000	9	5333	72	4·88
14	9000	45000	9	5333	48	5·00
15	2600	14000	3	5333	72	5·38
16	8400	44000	9	5333	48	5·23
17	9000	45000	9	5333	72	5·00
18	9000	45000	9	5333	48	5·00
19	9000	47000	9	5333	72	5·22
20	9000	43000	9	5333	48	4·77
21	9000	49000	9	5333	72	5·44
22	9000	50000	9	5333	48	5·55
23	9000	46000	9	5333	72	5·11
24	9000	46000	9	5333	72	5·11
25	9000	44000	9	5333	72	4·88
26	9000	45000	9	5333	72	5·00
27	8400	42000	8·5	5333	72	5·00
28	9000	46000	9	5333	72	5·11
29	9000	49000	9	5333	72	5·44
30	9000	44000	9	5333	72	4·88
	247,400	1,238,000	8·28	149,324	1848	5·00

3720 bus. charcoal coarse. 960 bus. charcoal fine. Tar 450 gallons.

Financial Exhibit of the Wood Gas Department for the Month of June, 1857.

Dr.		Cr.	
To 136·8 cords wood, (carbonized and fuel) at 4·11,	$570·45	By 1,238,000 feet of gas at 2·00 pr 1000,	$2476·00
" hauling 136·8 cords, 0·25,	14·20	" 3720 bus charcoal at 10c.,	372·00
" 1848 bus. lime for purifier at 9c,	166·32	" 48 loads fine " 25c.,	12·00
		" 1848 bus. lime at 4c.,	73·92
" wages, Stockers, Purifiers, Yardmen, &c.,	367·88	" 15 bbls. tar (30 gals. each) 450 galls. at 1c,	4·50
" coke for drying wood,	18·00		
" wear, tear, and renewals,	107·00		
" balance net gain,	1694·57		
	$2938·42		$2938·42
		By net gain month June,	$1694·57

The cost per thousand feet, (sales of by-products deducted,) is 67 cents, leaving, after making a proper allowance for distribution, a clear annual income of $16,600 from nine retorts, the cost of which with their connexions, would be about $2500.

---

*On Engraving by Light and Electricity.**

A very interesting lecture, "On the Application of Light and Electricity to the production of Engravings—Photogalvanography," was recently read at the Royal Institution, by Thomas A. Malone, F. C. S., Director of the Laboratory in the London Institution. The subject is one with which the speaker has for some years been practically acquainted. In 1844, he experimented for many months upon the engraving process of M. Fizeau, of Paris, in conjunction with M. Claudet and M. Fizeau. Since that time he has closely watched all the steps of improvement that have been taken, down to the latest investigations of Talbot, Niepce de St. Victor, Pretsch, and Poitevin. The following is a report of the lecture:

The methods devised for the accomplishment of the certain perpetuation and cheap multiplication—by means of printer's ink and the ordinary printing presses—of the images of natural objects, as obtained in the camera obscura by the processes of ordinary photography, may be arranged under three great divisions.

The *first* method, in which light was used to aid the engraver's art, was almost coeval with the first attempts made to produce sun-drawn pictures. Indeed, it had been asserted† that photography and photographic engraving were invented between the years 1813 and 1827, by one man, Nicéphore Niepce, of Chalone on the Saône. A reference, however, to the *Journal of the Royal Institution*‡ would show that photography really sprang from the labors of Thomas Wedgwood and Humphrey Davy, as far back as the year 1802.

Although we cannot accord to Nicéphore Niepce the merit of originating photography, we must give him the undivided title of founder of the art of photographic engraving, and, moreover, acknowledge that he was the first to fix not only *a direct positive* photograph, but also to secure on metal and glass plates the images of the camera, and this long before Daguerre produced his wonderful plates. Niepce's method was beautifully simple. He took Jew's pitch or asphaltum, and upon it poured oil of lavender to resolve the bitumen into a varnish with which he could coat plates of metal or glass. A plate, coated and dried, was exposed to the light with an engraving super-imposed, or it was placed in the field of the camera obscura, and a photographic image was obtained on the varnished plate. This image was *not visible.* The plate had to be submitted to the solvent action of a mixed liquid, composed of one part of oil of lavender, and ten parts, by measure, of *white oil of petroleum*, or mineral naphtha. On immersion in this fluid, wherever the light

* From the Lond. Mech. Mag., April, 1857.

† By a correspondent in the *Mechanics' Magazine*, vol. lxv., pp. 277 and 326.

‡ *Journal of the Royal Institution*, vol. i. p. 170.

acted, the varnish became insoluble, and in a certain degree proportionately so to the intensity of the light. There were not only lights and shadows, but half tints. The picture, as soon as developed by the solvent, was removed, drained, and washed with water to check all further action. The shadows of the picture were now represented by the parts of the white metal or glass plate laid bare; the lights were given by the film of varnish which the light had hardened, and the solvent had left untouched. The plate, now finished, was capable of being etched by simply pouring engraver's acid upon its surface. The varnish would protect the metal over the lights of the picture; while the shadows, the bare metal, would be bitten in. On removing the varnish, the plate could be inked and printed from. Such are the essential details of the first of the photographic engraving processes. The specimens on the table of the Institution were presented in 1827 to Mr. Bauer, late of Kew, by Nicéphore Niepce, who for a short time resided at Kew, on a visit to a brother in infirm health. Niepce prepared a statement regarding his invention, for presentation to the Royal Society; but as he at that time kept his process secret, his manuscript was not published. Niepce appears to have returned to France, disappointed at his ill fortune.*

Niepce's bitumin process was improved by his nephew, M. Niepce de St. Victor, who has published a treatise† on it, giving the necessary minute instructions. The main features do not differ from those above given, though greater sensitiveness and perfection have been obtained. The process is still under trial; but the difficulties of obtaining a constantly uniform result at present stand in the way of its general adoption. It still deserves a thorough investigation.

The *second* method of producing photographic engravings is founded upon certain properties possessed by the Daguerrean image. It is found that a daguerreotype, unfixed by gold, is acted upon by nitric acid in its shadows, while the lights long resist the biting action of the acid. An etching is obtained by merely leaving diluted nitric acid in contact with the plate. The etched plate is then inked and printed from, as in Niepce's case. Dr. Donné, of Paris, appears to have been the first to devise this method; but the action is not easily controlled, and the process has fallen into disuse. In 1842, Mr. Grove published in the *Philosophical Magazine* a method by which Daguerre's images can be engraved by the chlorine evolved by voltaic action, when the daguerreotype plate is made the positive terminal of the battery, and immersed in diluted hydrochloric acid; the negative wire being terminated by a plate of platinum, which was placed opposite and parallel to the photographic image. This process is much more under control than the last, and is also worthy of further investigation. Here the image is truly drawn by light and *engraved by electricity.*

M. Fizeau, about the year 1844, also patented in this country, in conjunction with M. Claudet, a process for engraving the daguerreotype image. The speaker was instructed in this process by M. Fizeau, and

*The statement made by our correspondent, Dr. Lotsky, upon this subject, in the passage referred to in a preceding note, is thus confirmed.

†Traité Pratique de Gravure Heliographique, par M. Niepce de St. Victor. Paris, Juin, 1856.

worked for many months at its perfection. Results obtained both in France and England showed that in cases were great delicacy of delineation was required, as in certain anatomical subjects, this process had not been surpassed. It quite justified the formation of a second division of the available photographic engraving processes.

M. Fizeau, like Mr. Grove, availed himself of the affinity of chlorine for silver, but relied on chemical action for its application. He (M. Fizeau) made a solution of common salt and nitrite of potash in water, to which he added nitric acid. This mixed acid acted immediately when aided by warmth, upon the silver of Daguerre's plate, and left untouched the parts supposed to be completely covered by mercury. Chloride formed of silver was thus at once formed in the shadows of the images, and after some time in the half tints also. A very faint etching was thus produced. A prolonged application of the acid would not further deepen the etching, since the insoluble chloride of silver at first formed, protected the faintly etched parts from a further deepening corrosion. It was therefore necessary to remove the chloride of silver by washing with a solution of ammonia. This effected, the plate was ready for a second application of the acid; and by this alternation of solutions, the etching was increased in depth. But it was found that after a few applications of the acid the lights of the image also gave way. To remedy this was M. Fizeau's great aim; and he succeeded by heating the etched plate in a strong and boiling solution of caustic potash; after this the lights resisted the acid's action. The heating in potash is an important feature in M. Fizeau's process. As soon as the etching has been carried as far as possible by the acid mixture, the plate is dried and inked with fine printer's ink, and an impression may be immediately taken; but M. Fizeau prefers that the ink should be allowed to dry in the hollows of the plate, and gold deposited upon the bright parts by the electrotype process. On now removing the ink, ordinary diluted nitric acid may be safely applied to deepen still more the shadows. This last step causes M. Fizeau's etchings to possess greater vigor than those obtained by Donné's or Grove's processes. M. Fizeau, foreseeing that the wear and tear of the silver plates might be considerable, thought to use the electrotype process to produce fac-similes of the engraved plates, reserving the original plate unworn to supply any further demands. The patent right in this process will soon expire.

The processes of the *third* and last division were, it must be confessed, very desirable, notwithstanding the numerous satisfactory specimens obtained, and still to be obtained, by the processes previously described. The truth seemed to be that none of the processes gave uniformly satisfactory results: hence the necessity of being acquainted with the capabilities of all the chief known methods, and of impartially comparing them with a view to produce any special required result.

Mr. Henry Fox Talbot opens the third division by his gelatine and bichromate of potash process, in which a steel plate is covered with a liquified jelly, containing bichromate of potash in solution. This jelly is allowed to dry upon the plate, and the gelatined plate may be used to reproduce engravings or the images of the camera; the light, as in Niepce's case, altering and hardening the gelatine whenever it fell with

sufficient intensity. Nitric acid acts so energetically and so uncertainly on the steel plate, that but little success would attend its employment. Accordingly, Mr. Talbot was led to seek a better engraving liquid. This was found in a solution of bichloride of platinum, which appeared to act in the desired manner. The advantage of any process on steel plates would be obvious from the great number of impressions that so hard a body would yield under the wearing action of the printing press. It might here be observed that the bitumen process had also been applied to steel plates by M. Mante, in a series of natural history plates, published in Paris, and also by M. Niepce de St. Victor, in the frontispiece to his treatise.

In 1854, Herr Paul Pretsch, of the Imperial printing-office of Vienna, patented in this country, and subsequently in France, a process which he has called *Photogalvanography*. He uses Mr. Talbot's materials, but with certain additions, and avails himself of a property of the gelatine which allows of his dispensing with the acid etching altogether. This process was described by the lecturer in terms substantially the same as those employed in the description given at page 415 of the sixty-fourth volume of the *Mechanics' Magazine*.

In all the engraving processes hitherto described, there is a difficulty in obtaining a granular surface over the etched parts necessary to hold the amount of ink required by the printer. In Pretsch's process this difficulty remarkably enough does not present itself; the swelled surface breaks up in a direction vertical to its surface into little masses, which are just what is desired; this result is quite characteristic. It has been attributed to the presence of particles of chromate of silver, or of iodide of silver. Would it be too far-fetched to suppose that it is another beautiful instance of the slaty cleavage action demonstrated by Mr. Tyndall?* However this may be, the fact is very important for the success of the invention. The chemistry of the processes of the first and third divisions of this subject is but little advanced.

M. Poitevin, of Paris, has applied the gelatine and bichromate of potash process to lithographic stone, and his results would well bear a comparison with those obtained by the other methods described in this division.

The speaker, in conclusion, expressed his opinion that these engraving processes would greatly advance the art of photography itself, particularly in its applications to the delineation of colored objects, in which it is still very imperfect, although some progress has been made.

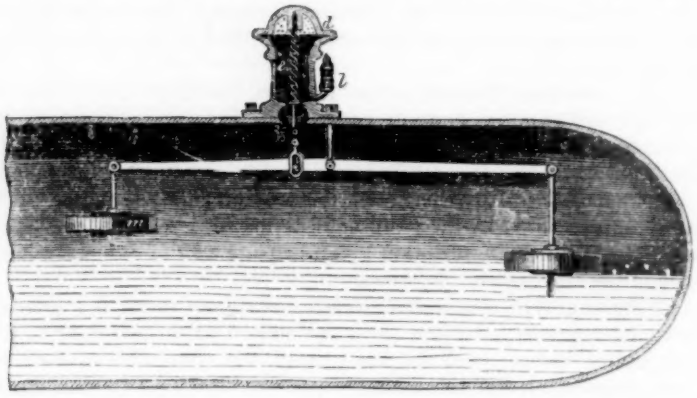
York's Indicator for Steam Boilers. †

This invention consists of an improved safety valve and low water, or high and low water indicator for steam boilers, as represented in the engraving. It has been patented by Mr. T. York, of Wolverhampton.

* We hope to give an account of of Dr. Tyndall's sagacious theory in an early number.—Ed. M. M.

† From the Lond. Mech. Mag., April, 1857.

a is a valve seat on the top of the boiler, upon which the valve, *b*, is pressed by the helical spring, *c*, the upper end of which bears against a shoulder on the dome, *d*, covering the box, *e*, in which the valve is contained. The dome, *d*, is perforated, as represented. A float, *f*, is suspended in the interior of the boiler from the end of a lever, *g*. A rod, *h*, jointed to the under side of the valve, *b*, is connected with the lever, *g*, by means of the slot, *i*, in which the pin, *k*, of the lever, *g*, engages,



so that the lever, *g*, has play within certain limits without affecting the valve; but when the water and float, *f*, descend below the proper level, the lever *g*, raises the valve, *b*, and permits of the discharge of the steam. As the steam escapes between the valve and valve seat, a portion of it is discharged into the whistle, *l*, and thereby gives notice to the engine-man that the water in the boiler is too low. The valve, *b*, acts as a safety valve when the water is at ordinary level, and rises whenever the pressure of the steam exceeds the pressure of the spring upon it.

A second float, *m*, is attached to the other end of the lever, *g*, as represented. If the water in the boiler rises too high, the float, *m*, becomes immersed, and raising the end of the lever, *g*, to which it is attached, lifts the valve, *b*, and the discharge of the steam and sound of the whistle, *l*, call the attention of the engine-man. The valve, *b*, thus acts as a safety valve and high and low water indicator.

Artificial White Sapphires.

Some ten years ago, the late M. Ebelman, then director of the government Porcelain Manufactory at Sèvres, succeeded in crystallizing alumina by slowly evaporating a solution of this substance in boracic acid, by the heat of his furnaces. The crystals thus produced were microscopic but possessed all the properties of the sapphire, ruby, &c., except the color. M. Gaudin states, in a communication made to the French Academy of Sciences, that he had succeeded ten years before

this, in making rubies artificially by calcining ammonia-alum with the addition of five thousandths of chromate of potassa, by the oxyhydrogen blow-pipe—but that the large globules were deficient in limpidity, owing to partial crystallization.

He now proposes the following process. Into an ordinary crucible lined with lamp-black, he introduces equal parts of alum and sulphate of potassa, previously calcined and powdered; the crucible is then submitted to a violent forge heat for a quarter of an hour. On breaking the crucible, there is found a mass studded with brilliant points, and consisting of sulphuret of potassium imbedding crystals of alumina. By dilute aqua-regia and heat, a precipitate resembling fine sand is obtained and must be washed several times.

The greater the mass operated on, the larger the crystals. Those obtained by M. Gaudin were 1 mm. ($_{2}^{1}{}_{0}$-in.) in length; and about one-third thick. These are said to have proved upon trial, to be harder than the natural crystals, and therefore more fitted for mounting watches; they were perfectly limpid when examined under a powerful microscope, but cannot be obtained colored in this way, in consequence of the reducing power of the carbon.

---

*Parchment Paper.**

At the Royal Institution, on the 3d inst., the Rev. J. Barlow gave a lecture on this subject. Mr. W. E. Gaine has discovered the remarkable fact, that by a momentary immersion of paper in strong sulphuric acid, diluted with half its bulk of water, and allowed to cool, and then instantly washing it free from acid, first in plenty of water, and then in weak ammonia, it becomes endowed with such extraordinary tenacity, that whereas a band of the original paper, of about an inch in width, breaks under a weight of seven or eight pounds; in its modified condition it will support nearly a hundred weight. The lecturer stated that Messrs. De La Rue & Co. had entered into an arrangement with the discoverer to introduce it into commerce, where, from its almost indestructibility, it will doubtless supersede parchment in many of its applications. Specimens of engravings were exhibited which had been so treated *after* having received the impression: the acid had in no way injured the lines of the engraving, whilst the great contraction which the paper underwent, gave a delicate softness and sharpness to the picture. Several photographs were likewise exhibited which had been printed on this parchment paper, as it is called, the peculiar hard nature of the surface enabling photographers, the inventor states, to obtain beautifully rich tones with far less expenditure of nitrate of silver than at present.

Mr. William Crookes, in a communication to the *Journal of the Photographic Society*, says:—

"On seeing the really wonderful change which had by this simple means been wrought in an engraving, the thought instantly occurred to me, what would be the effect of treating a finished photograph in this manner? We know of many instances in which a strong acid exerts

* From the Lond. Journ. of the Society of Arts, No. 231.

apparently less energetic action on bodies than the same acid diluted; and it was just possible that the metallic compound, whatever it may be, constituting the dark part of a positive paper photograph, might pass unscathed through the ordeal; the idea was at all events well worth putting to the test of experiment, and, accordingly, the same night, strips of photographs, selected as samples of different tones of printing, and various kinds of paper, were passed through the acid according to the plan above stated.

"The result was one which I had certainly not anticipated: the color and tint of the picture, even in the most delicate half-tones, remained perfectly intact, while the powerful yet uniform contraction of the paper added considerably to the sharpness; the paper was, besides, suddenly gifted with such great strength, that not only would it bear the roughest handling during the washing operation, without even the possibility of tearing it; but at any after-time, when finished and mounted, it would bear hard rubbing with soap and water and a wet cloth, without the slightest roughening or abrasion of the surface, if it were sufficiently dirty to render such a mode of treatment advantageous. Added to this, the surface (of an unalbumenized print) assumed a peculiar glossy appearance, giving a richer finish to the picture, without the glare which is so much objected to in albumenized pictures. Another effect, which time alone can decide whether or no it may be added to this long list of advantages, was this: a picture which was fading rapidly, was so treated on one-half only; there was a powerful odor of hydro-sulphuric acid evolved, and certainly there has been no further fading since, although the short space of time which has elapsed since trying the experiment, makes it difficult, as yet, to appreciate any difference between the two halves as regards their intensity."

---

*On the Preparation of a Writing-ink in Cakes.** By A. LEONHARDI.

After the author had discovered the mode of preparation of the so-called alizarine-ink, which is particularly useful, he was anxious to prepare it in a form which would allow it to be sent to a great distance and at any time of the year, render its transport convenient, and diminish its cost considerably, but at the same time fulfil all the requirements of an excellent article. This is attained by the dry alizarine-ink in cakes. The "ink-powders" hitherto found in commerce are not to be compared with it, for they not only possess a different composition, but never dissolve completely to form a clear solution in water, and their employment is attended with so many inconveniences and disadvantages, that they have been given up. Common black ink may indeed be evaporated to dryness, but it leaves a residue which does not again dissolve completely in water, and never furnishes a useful ink by this solution. The recipe for the preparation of the cake-ink is as follows:—

42 parts of Aleppo galls and 3 parts of Dutch madder are extracted with a sufficient quantity of hot water; the fluid is then filtered, 5½ parts of sulphate of iron are dissolved in it, and 2 parts of a solution of iron

* From the Lond. Chem. Gaz., No. 346.

in wood-vinegar, with $1\frac{1}{8}$ part of solution of indigo, are added to it. The mixture is evaporated to dryness at a moderate heat, and formed into cakes of a proper size (for instance 5 inches long, $3\frac{1}{2}$ inches broad, and $\frac{3}{8}$-inch thick).

1 part of this ake-ink dissolved in 6 parts of hot water, furnishes an excellent writing and copying ink, whilst even with 1 part of cake-ink and 10 to 15 parts of water, beautiful writing-inks are obtained.—*Mittheil. des Gewerbe-vereins für das Königr. Hannover*, 1856, p. 249.

On some Modifications of Woody Fibres and their Applications.

By the Rev. J. Barlow.

Having called attention to the chief physical peculiarities of woody fibre,—strength, flexibility, elasticity, combined with readiness to take a permanent set or bend, Mr. Barlow first noticed the ingenious application of these qualities devised by Mr. T. Blanchard, of New York, and adopted by the Timber Bending Company. Large beams of timber can be made by end pressure, to take any amount of flexure, are strongest in the bent portions, and yet will break before they can be straightened by mechanical force. Mr. Barlow then referred to the known chemical composition of woody fibre—the material of paper—as consisting of carbon, and of hydrogen and oxygen, in the same proportion as these elements exist in water. Although extremely averse to chemical change, this, in common with other organic substances, has been made to exchange a certain amount of its hydrogen constituent for an equivalent amount of hyponitric acid (NO_4). The discoveries of Braconnet, Pelouze, and Schönbein were briefly adverted to. It was shown, that paper, as operated on by Pelouze's process, is a substitution-product, and, consequently, increased in weight. It is also both combustible and electrical in the highest degree. In reference to this subject, Mr. Barlow invited attention to some recent experiments of M. Kuhlmann, of Lille,—the results of which the courtesy of that gentleman enabled him to exhibit to the meeting. M. Kuhlmann has ascertained that no form of gun-cotton, whether woven or not, will receive dyes, but that when it has lost part of its nitrous principle, by spontaneous or artificially produced decomposition, the vegetable fibre absorbs colors more energetically than it did in its natural state. But the chief subject of Mr. Barlow's discourse, was supplied by a recently invented method of investing ordinary paper with many of the most useful properties of parchment, and also of imparting to it some qualities which parchment does not possess. This discovery was made and patented by W. E. Gaine, Esq., C. E., and it is about to be introduced into commerce by Messrs. Thomas De La Rue & Co. That cold solutions of caustic alkali and chloride of zinc, as well as sulphuric acid, impart strength and fineness to textile fabrics, was discovered some years since, by Mr. J. Mercer; and the fact has been scientifically investigated by Dr. L. Playfair, C. B., and also by Dr. Gladstone. Mr. Gaine ascertained that, of these reagents, sulphuric acid alone was applicable to paper. The effect he

* From the Lond. Athenæum, April, 1857.

sought to accomplish was best attained by merely drawing a piece of common unsized paper, through a mixture of two parts of concentrated sulphuric acid with one part of water, and then immediately and thoroughly washing it in water. If the acid either exceeds or falls below the above-named strength, then the quality of the "*parchment paper*" (the name by which the substance thus produced is to be designated) is deteriorated. It is, in fact, at this strength only that the acid produces its full sizing effect, and enables the paper parchment to bear writing ink. Parchment paper thus prepared, is so strong, that a ring of it $\frac{3}{8}$-inch in width will sustain from 63 to 100 lbs., (a ring of parchment of the same weight and dimensions supporting about 56 lbs.) Parchment paper, though it absorbs water, does not permit water to percolate through it. It is not disintegrated by water, and (unlike parchment) is not destroyed by warmth and moisture. The weight of the paper is not augmented by its conversion into parchment paper, proving the entire absence of sulphuric acid. The strength of this substance, and its resemblance to parchment, commend it for purposes in which strength and durability are requisite; such as legal deeds, policies of insurance, scrip-certificates, books subject to great wear and often referred to, (as school books, registers, &c.) Having all the appearance of vellum, it is likely to supercede the use of that substance in book-binding. It is also suitable for receiving oil colors. A map and a lithographed engraving, which had been subjected to this process, were exhibited. The smoothness of their surface, and their perfect condition, led to the expectation, that prints thus prepared, were not likely soon to become soiled, and that, whenever this occurred, they might be easily and safely cleaned. This extraordinary conversion, effected in a moment of time, rendering that which was previously weak, porous, and disintegrable, a substance of singular toughness, through which water cannot flow, neither disintegrate it, cannot be easily accounted for. It must, for the present, be referred to that mysterious influence, by which bodies occasionally seem to effect, by their mere presence, changes in other bodies, themselves remaining unaltered. *Proceedings of the Royal Inst., April 3d*, 1857.

Smokeless Furnaces.

M. Dumery from a committee appointed to report upon an apparatus for slow combustion, erected in the Museum of Natural History, at Paris, reports to M. Flourens, the Director, that,

1. The quantity of fuel (*charbon,*) consumed per area of grate, may, in this new apparatus, vary in the ratio of 1 to 8 without producing smoke, and without a loss of advantage greater than from 3 to 2·2.

2. That the advantages obtained are greater in proportion as the quantity consumed in a given time per square foot of grate surface is less: in other words, while with a consumption of 26 lbs. per square foot, the economy was 22 per cent., when the consumption was lowered to one-third of this, the gain was 30 per cent. over the ordinary furnaces working under the same conditions.—*Academy of Sciences of Paris, 6th April*, 1857.

*Artificial Fuel for Burning Bricks.**

Mr. C. D. Gardissal, of Bedford Street, Strand, has patented a new combustible compound, composed of clay, coal-dust, and a nitrate, or nitric acid. The essential base is clay or marl, and a mixture of both; this base is worked up with a solution of alum, a certain quantity of nitrate of soda, or potash, and charcoal, or other coal-dust; the largest particles should not exceed the size of small peas. All the materials foreign to the clay combine with, and are diffused throughout the whole mass, in the proportion of about 17 per cent. These combustible bricks not only bake the others in the kiln, but bake themselves, and are removed from the kiln perfectly porous bricks, which may be used for the same purpose as ordinary ones.

Moulds of Stearic Acid and Shell-lac for Galvanoplastic Copies.

By M. Phil.†

The best material for moulds is prepared from equal parts of stearic acid and shell-lac. The stearic acid is melted first, and the shell-lac is then added in small fragments; the mass is heated until it may be ignited. It is allowed to burn until the shell-lac which has been separated from the stearic acid by the great heat, may be again combined with it. It is burnt until a drop let fall upon a cold metal plate receives the black lead readily after its solidification. The mass is poured into a paper box, and its surface rubbed with black lead.—*Polyt. Notizblatt*, No. 13, p. 193.

The Telescopic Stereoscope.‡

To the Editors of the Philosophical Magazine and Journal.

Gentlemen :—Since sending you the account of the stereoscopes proposed by myself and Mr. Waterston for uniting large binocular pictures, my attention has been called to a description, contained in Sir David Brewster's Treatise on the Stereoscope, of an instrument so nearly resembling what I have called the telescopic stereoscope, that, had it not entirely escaped my recollection, I would never have spoken of mine as new. The only difference, beyond unimportant details, is that the instrument described by Sir David Brewster appears to have been intended only for small pictures near at hand, while mine was designed to unite large pictures viewed at a distance. The latter object *alone* being that which I had in view, and recollecting no description of any instrument *for that purpose* in Sir David's work, it did not occur to me to search the volume again before sending you my account, although I endeavored in every other way to ascertain if such a form of the stereoscope had ever made its appearance. I now, however, take the very earliest opportunity of making the acknowledgment, and hope you will be able to give it a place in your forthcoming Number.

Edinburgh, *Feb.* 10, 1857. James Elliot.

*From the Lond. Mining Journal, No. 1129.

†From the Lond. Chem. Gaz. No. 351.

‡From the Lond., Edin., and Dub. Philos. Mag., March, 1857.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, July 16, 1857.

John Agnew, Vice President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were received from the Smithsonian Institution, and Prof. A. D. Bache, Superintendent of the U. S. Coast Survey, Washington, D. C.; The Ohio Mechanics' Institute, Cincinnati, Ohio, and Messrs. Caldwell and Ghrisky, Ellwood Morris and Wm. H. Jones, Philadelphia.

Donations to the Cabinets of Models and Minerals from Isaac R. Trimble, Esq., Baltimore, Maryland, Messrs. Williams & Page, Boston Mass., and John C. Trautwine, Esq., Philadelphia.

The Periodicals received in exchange for the Journal of the Institute were laid on the table.

The Treasurer's statement of the receipts and payments for the month of June was read.

The Board of Managers and Standing Committees reported their minutes.

New candidates for membership in the Institute (3) were proposed, and the candidates (3) proposed at the last meeting were duly elected.

A specimen of scale-encrusted tube, taken from an ocean steamer, was laid upon the table. It was a section of a vertical tube, covered evenly with calcareous deposit, about five-sixteenths thick. The material of the tube (brass,) did not seem injured, as might be expected, from being coated with so thick a non-conductor; probably being preserved by the rapid circulation of water incident to vertical tubes. When it is considered how easily the interior of tubes are cleaned, such instances can only occur through wilful neglect. Some of the Government steamers, having boilers similar to the one from which the tube was taken, have been almost constantly in service, and have never had scale of a greater thickness than that of an egg shell upon the tubes.

Mr. C. Brigham exhibited his design for a cast iron rail for city passenger railroad. Its peculiarities are: no ties are needed, a flanch cast on the under side gives a sufficient base; at the top, on each side, are a series of angular projections flush with the top or head of the rail, on the outer side, while on the inner side they are below (about half an inch,) sufficiently to clear the wheel flanches; between the projections on the outside, cubical blocks are to be fitted, and on the inside the ordinary cobble stones are to be put.

It is claimed that the cast iron projections will prevent the wearing of the stones into ruts by vehicles, the spaces between the projections being but about nine inches: wheels of ordinary vehicles would not sink or wear away the stone blocks to any injurious amount, before the abrasion would be arrested by the wheels coming in contact with the hard material of the casting. It is expected that the difficulty experienced in crossing railroads on an angle will be greatly reduced from the

trifling difference in the level of the inner and outer projections, which represent the paving on the inside and outside of road, and which will not be increased by ruts.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Dr. Charles M. Cresson's Cellular Gas Retort.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination the Cellular Gas Retorts, invented by Dr. CHARLES M. CRESSON, of Philadelphia, Penn.,

REPORT:—That the invention consists in arranging a system of cells in the walls and especially in the bottoms of the retorts, which cells are so connected, by omitting the dividing walls alternately at the two ends, as to constitute a continuous passage, opening at one end into the retort, and at the other, giving exit to the gas into the main. In this way the gas is maintained for a considerable time at a moderate red heat while it slowly traverses this passage. In the retorts in use at the Philadelphia Gas Works, the cells are in the bottoms of the retorts only, and are eight in number in each retort, each two inches wide, four inches deep, and six feet long; so that the gas is made to traverse slowly a space of 48 feet, and during the time thus occupied, is subjected to a regulated and moderate temperature.

The effect of such an arrangement is two-fold; in the first place, it must modify, to a considerable extent, the temperature of the body of the retort itself, which has thus interposed between it and the heat of the furnace-flues, the gases contained in the cells. The retorts will thus be less violently and more steadily heated, and the nature of the gases developed, may, as is well known, be thus considerably modified.

Secondly, it would seem possible that a material change in the chemical nature of the gases may be produced by the maintenance of this temperature for a considerable time.

Heretofore, these retorts have been exclusively employed in the manufacture of gas from wood, and the practical result has been that, whereas, according to the experience of the gas works in the City of New York, the gas from wood manufactured in the ordinary retort cannot be economically used, owing to its low illuminating power; the gas from wood manufactured in this city in the cellular retort, exhibits at the present prices of wood and coal, a slight superiority in economical value over coal-gas. The wood used has been principally common pine, and, as the apparatus has been used merely as an adjunct to the coal-works, and is comparatively on a small scale, no provision has been made for properly seasoning, drying, or splitting the wood. For the most part the wood had been distilled in large sticks, dried for a few hours only, and requiring some four hours to exhaust the volatile matters. Experiment, however, has shown that the capacity of the apparatus can be largely increased by diminishing the diameter of the wood, and by thorough drying. By proper attention to these points, the same weight of charge can be burned off in 1½ hours with an increased yield

of gas per pound. In this way, a retort that will yield ordinarily 4500 cubic feet of gas in 24 hours, can be made to produce over 9000 cubic feet in the same time. By careful working, 10,000 cubic feet have been obtained with the same amount of fuel and labor as are ordinarily used for two-thirds that amount of coal-gas.

The following are the statements of the results actually obtained with these retorts:—

Experimental Trials.

April 29 and 30, 1856. 6 retorts in action—duration of trial 48 hours.
Large pine wood—3 hours charges.
14,400 pounds of wood produced 76,000 cubic feet of gas,
Being 5·27 cubic feet to pound, or 15,800 cubic feet to cord. 6333 cubic feet to retort in 24 hours.

June 12 and 13, 1856. 6 retorts—3 hours charges—duration of trial 48 hours.
Pine wood split and partially dried.
12,000 pounds of wood produced 76,000 cubic feet of gas,
Being 6·33 cubic feet to pound, or 18,900 cubic feet to cord.

July 31st, 1856. 6 retorts—hourly charges.
Pine wood, split small, and dried.
14,400 pounds produced 62,000 cubic feet of gas,
Being 4·30 cubic feet to pound, or 12,900 cubic feet to cord.

In this trial the charges were not thoroughly burned off—the charcoal being smaller but of better quality.
10,333 cubic feet to retort in 24 hours.

March 1, 1855, *to March* 1, 1856.

Wood used in retorts.	Gas produced.	Fuel used, (coke exclusively.)
2,896,578 lbs.	11,860,425 cu. ft.	33,906 bus.

Average make per pound for year, 4·09 cubic feet.
equal to 12,200 cubic feet per cord.
Maximum monthly make = 4·83 cub. ft. per pound.
equal to 14,490 cub. ft. to cord.
350 cubic feet of gas were produced for each bushel of coke used as fuel.

March 1, 1856, *to March* 1, 1857.

Wood used in retorts.	Gas produced.	Fuel used, (wood exclusively.)
1,840,265 lbs.	8,306,000 cub. ft.	1,380,000 lbs.

Average make per pound for year, 4·51 cubic feet.
equal to 13,530 cub. ft. per cord.
Maximum monthly make, 5·61 cub. ft. per pound.
equal to 16,830 cub. ft. per cord.
Average charge 137 pounds per retort.
" retorts in action 6.
Yearly production per retort 1,384,333 cubic feet.
Average duration of retorts, 12 months.
18,000 cub. feet of gas produced per cord of wood as fuel.

As every invention by which the price of gas is diminished, either by increasing the yield, by diminishing the first cost of the apparatus, or the expense of its maintenance, or by substituting other materials for those which have been heretofore exclusively used in this manufacture, is of the greatest importance to the community, the committee deem the gas retorts of Dr. Cresson to be a very valuable improvement, and recommend them to the attention of those engaged in the manufacture of illuminating gas.

By order of the Committee,

Philadelphia, June 11th, 1857. WILLIAM HAMILTON, *Actuary.*

Messrs. Butcher's Composition for Coating Iron.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "a Composition and Process for Coating Sheet Iron to be used for Roofing," &c., invented by Messrs. Wm. Butcher & Son, of Philadelphia, Penna.

REPORT:—That the iron is prepared by heating to a point below redness, and plunging it into a bath of preparation or coating consisting of linseed oil, gum-elastic, lead, and other ingredients, made known to the Committee, the iron thus coated is finished by baking until the surface is dry; it then presents a tolerably even surface of elastic varnish or japan, which possessing considerable flexibility, enables the iron to be folded short without cracking or scaling, and from its close adhesion to the iron prevents the action of atmospheric moisture.

The numerous joints made when turned plates are soldered together to form a roof, are a very objectionable feature in the use of that material, as the roof becomes leaky mostly at the soldered joints, which is due to galvanic action from moisture getting to the metal through the imperfect coating of paint which is applied with a brush, and cannot be covered so well as in the process patented by Messrs. Butcher.

The length of the sheets of prepared iron is such that but few joints are required in a roof of ordinary size, and these are made by folding in such a way as to allow for expansion and contraction due to atmospheric changes.

The spouts or guttering made of the prepared iron, appears to be far more durable than tinned iron, as the tube is coated after it is formed, and is protected by the composition within and without.

The Committee can see no reason why the prepared iron of Messrs. Butcher should not be used as a valuable material for roofing, especially as a substitute for tinned plate, as its first cost is less and having fewer joints, must be less liable to leak.

By order of the Committee,

Philadelphia, July 9th, 1857. WILLIAM HAMILTON, *Actuary.*

BIBLIOGRAPHICAL NOTICE.

Hand-book of Railroad Construction. By GEORGE L. VOSE, Civ. Eng. Published by L. Munroe & Co.: Boston, 1857.

We have been presented with a copy of this valuable work for the Library of the Institute.

It is an octavo volume of 480 pages, illustrated by 158 wood engravings.

It commences with an introduction, giving a brief sketch of the history of railroads, and the general principles controlling their construction and operation.

Then follow sixteen chapters, detailing the various operations from the reconnoisance of the route, through all the minutiæ of construction, down to the final equipment, and the after management in operation.

The chapters on *survey*, *location*, *bridging*, *equipment*, and *management*, are particularly valuable.